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RESECTION OF LUNG TISSUE FOR PULMONARY TUBERCULOSIS.¹

By C. J. OFFICER BROWN,
Melbourne.

In 1881 Block removed both apices at one sitting for bilateral pulmonary tuberculosis. The patient subsequently died and Block committed suicide because of the surgical failure. In the next fifteen years various other surgeons attempted resection for pulmonary tuberculosis and had they followed Block's example the mortality amongst surgeons would have been high. After these early failures the method was practically abandoned until 1933, when Lillenthal reported a total pneumonectomy for sarcoma in a patient with pulmonary tuberculosis.

In 1934 Freedlander successfully performed the first planned lobectomy for this disease, and since then resection has found an increasingly important place in its treatment.

In 1942 Thornton and Adams reviewed from the recent literature a series of 29 cases of pneumonectomy and 46 cases of lobectomy for pulmonary tuberculosis. The mortality for pneumonectomy was 45% and for lobectomy 25%. The most common complications were persistent fistula, contralateral spread and empyema. The authors concluded that "resection of lung tissue is very hazardous in the presence of a positive sputum—if possible collapse therapy is to be preferred". Most of these early resections were done by the tourniquet method and often the diagnosis was made only after the operation had been completed. Improvements in operative technique and especially the introduction of the method of dealing with the hilar structures by individual ligation with meticulous bronchial closure

resulted in great improvement in these results, and in 1945 Overholt stated that these developments had almost eliminated bronchial fistula and empyema as complications; contralateral spread and ulceration of the bronchial stump remained as real hazards. He reported 45 resections in 44 patients with an operative mortality of 11.1%, and if nine patients whom Overholt classed as desperate risks are excluded, the operative mortality was 5.5%. Since 1945 the introduction of the face-down operating position by Overholt and the use of occlusive endobronchial catheters to limit the overflow of secretion from the diseased lung during the course of operation has lessened the frequency of early post-operative contralateral spread, and it seems likely that the prophylactic use of streptomycin will further reduce its incidence. We hope that streptomycin will also control ulceration in the bronchial stump.

In May, 1946, Overholt reported a series of 69 lobectomies with a mortality rate of 7.3%; five patients died later of spread of the disease, making a total mortality up to the time of writing of 14.7%. At the same time he reported 129 pneumonectomies with an operative mortality of 17.3%, and there were 14 late deaths up to the time of his writing, making the total mortality 28.3%. These figures represent Overholt's total experience and cover the whole period of technical developments, and the present position is more accurately represented by the cases in which he operated during the preceding two years. In this series there were 35 lobectomies with four deaths. Among the survivors, 20 or 57% were clinically well, with "negative" sputum, and in 7 or 20% of cases the results were too recent for classification. During the same period he had performed 69 pneumonectomies and, among these, 12 patients were dead; 47.8% of patients were clinically well with "negative" sputum and 11 operations were too recent for classification of results.

At the same meeting of the American Association for Thoracic Surgery, Sweet reported his experience with 27 lobectomies and 36 pneumonectomies. Two patients died as the result of the operation of lobectomy and five of the

¹Read at a meeting of the Sections of Anæsthesia, of Surgery and of Public Health, Tuberculosis and Tropical Medicine, Australasian Medical Congress (British Medical Association), Sixth Session, Perth, August, 1948.

survivors later succumbed to the disease; so that at the time of writing seven of the original 27 patients were dead, 13 of the surviving 20 patients were apparently well with "negative" sputum, seven of the 36 patients subjected to pneumonectomy died of the operation, of the survivors seven more died of the disease and 17 were apparently well. One of these 17 still had a positive sputum.

In criticizing these results it must be remembered that patients subjected to resection for pulmonary tuberculosis are usually those for whom no other form of treatment holds out any prospect of a cure.

Indications for Resection.

Resection may be considered for the following five conditions: (a) high-grade bronchial stenosis, with or without associated suppurative disease; (b) tuberculoma; (c) cavity persisting after thoracoplasty; (d) lower lobe cavities which have resisted other methods of treatment; (e) massive acute tuberculosis which is unilobar or unilateral, when the patient's condition is deteriorating, despite bed rest and streptomycin.

High-grade bronchial stenosis is accepted by most authorities as an indication for pulmonary resection. In most cases a main stem bronchus is involved and pneumonectomy is required, but sometimes the stenosis involves a lobar bronchus, and in these cases, if the disease is limited to one lobe, lobectomy may suffice. In most of these cases the whole lung is opaque and contains one or more cavities which may or may not be recognizable in the films. In the absence of superimposed infection these cavities are filled with creamy tuberculous pus which constantly seeps past the stenosis, maintaining a "positive" sputum and a varying amount of expectoration. Most of these patients are constantly febrile or may have exacerbations of fever, and all of them suffer from some degree of toxæmia. The lung or lobe behind the stricture is always completely functionless and contracted. It is true that if the stenosis is not extreme or if the lumen can be maintained by repeated bronchoscopic dilatation, thoracoplasty may control some of these conditions, but the post-operative course of the patients is likely to be stormy, and we feel that pneumonectomy for them is the safer operation. When putrid infection is superadded, resection offers the only chance of survival.

Tuberculoma presents a much less certain indication. It must be recognized that some tuberculomata calcify and dry in and become healed, and that in other cases the tuberculoma breaks down, is softened and discharges itself without any spread of the disease. We have had one patient who developed a tuberculoma which became calcified and ultimately disappeared with complete clearing of the lung fields. Presumably the calcareous nodule was expectorated as a lung stone. Despite the favourable course in some of these cases it seems probable that a large proportion of tuberculomata break down, and for this reason we have advised resection in a number of cases.

With proper selection of cases thoracoplasty produces a high proportion of good results with cavity closure and sputum conversion, but there is always a residuum of failures. Some of these patients will remain well for years with scanty although persistently "positive" sputum, but in many the persistence of a cavity spells disaster. Where thoracoplasty has failed, the choice lies between revision thoracoplasty, open cavernostomy or resection, and where it can be used resection is likely to prove the most satisfactory of these methods. It is fortunate that the majority of tuberculous cavities occur in the upper part of the lungs, where they are most amenable to closure by collapse methods. Lower lobe cavities may be closed by pneumothorax or by phrenic paralysis and pneumoperitoneum, but after these methods have been tried and failed resection may have to be considered. Bronchoscopic examination is always indicated in these cases.

Massive unilobar or unilateral tuberculosis is rapidly fatal in almost all cases. Streptomycin may control some of these infections and should always be tried, but if the fever persists and the patient's condition deteriorates despite its use, immediate resection may be considered and in a few cases has produced brilliant results.

At the present stage of its development resection should be looked on as an additional method of treatment and not as an alternative to well-tried collapse methods. It is generally chosen for cases in which these methods have failed or are inapplicable, but the possibility that it may become a standard method of treatment for early unilobar disease must not be forgotten.

In 1944 Churchill and Klopstock reported a series of six successful lobectomies for pulmonary tuberculosis, and in three of these they had deliberately chosen it as an alternative to thoracoplasty when this operation would ordinarily have been considered indicated. Results in this small series were highly satisfactory.

In 1947 Duncan and Carpenter reported a series of five cases of unilobar tuberculosis suitable for other forms of treatment, but deliberately treated by lobectomy. They chose patients with unilobar disease showing evidence of progression, under conservative therapy, and in whom there was no evidence of bronchial ulceration or tuberculous granulations in the bronchial tree, and their aim was to remove all the tuberculous disease recognizably present. The patients were allowed up early, but were maintained on a modified sanatorium régime for three months. One of the patients ignored these instructions and indulged in active athletics within three or four weeks of his operation without any apparent ill results. All of them did well. It is generally felt that even minimal tuberculosis is rarely sufficiently localized for this form of treatment to be successful, but future developments may prove that this view is not correct.

The complications common to all surgical procedures and those especially liable to follow pulmonary lobectomy or pneumonectomy because of the character of these operations need not be specially discussed; but there are some complications which create a special hazard when pulmonary resection is carried out in the presence of tuberculosis.

Sequelæ of Operation.

Tuberculous Wound Infection.—Wound infection occasionally follows surgical encroachment on a tuberculous lesion. It occurred four times in Overholt's 200 reported resections. In all four cases it was associated with a tuberculous empyema.

Bronchial Fistula and Empyema.—In the early days of resection for pulmonary tuberculosis bronchial fistula and empyema were frequent and these complications were often fatal. An empyema is usually secondary to a fistula and it has been found that the escape of pus from tuberculous cavities into the pleural cavity during operation is not always followed by empyema. On the other hand, if tuberculous tissue is left adherent to the chest wall or elsewhere in the pleural cavity, an empyema is almost inevitable. With modern dissection technique a bronchial fistula rarely follows lobectomy unless the remaining lobe fails to expand in the early post-operative period; in the 62 lobectomies performed by Overholt with the technique that he now considers satisfactory, only one patient developed a bronchial fistula and an empyema. After pneumonectomy there is no lung left to expand and cover the bronchial stump and become adherent, and consequently the risk of fistula and subsequent empyema is greater. Fistula is to be avoided by dividing the stem bronchus deep in the mediastinum right up to the carina, so that it will be surrounded by cellular soft tissues which heal around it and reinforce the healing of the bronchial wall. Many variants of technique are urged by different writers, but I feel sure that the important factor common to all is the high division of the bronchus with retraction of the closed stump into the mediastinum. We close the end with interrupted end sutures of stainless steel wire, and where possible draw the mediastinal pleura over the slit in the mediastinum, in the depths of which the bronchial stump is lying. A fistula following lobectomy is likely to heal with adequate treatment of the empyema, but a fistula following pneumonectomy is serious and extremely difficult to close. It will result in an empyema which must be drained, but after drainage escape of air through a large fistula may make talking and coughing almost impossible and is very distressing to the patient. Infection of the

fluid which accumulates in the dead space of the empty pleural cavity may result in a pyogenic or a pure tuberculous empyema. In the absence of a fistula most of the pyogenic empyemata will respond to drainage and thoracoplasty and the same treatment may be successful with a tuberculous empyema without a fistula, but here a cutaneous sinus may persist. An empyema complicated by a fistula is very much more serious, and the mortality in this group is likely to be high because of the frequency with which contralateral spread will occur. In Overholt's group of 69 pneumonectomies, where he considered the technique satisfactory, there were two cases of tuberculous empyema with fistula and five without fistula. Only one non-tuberculous empyema occurred, and this was not complicated by fistula.

Post-Operative Spread of the Disease.—Following lobectomy, fresh disease may appear or old lesions may become reactivated, either in the ipsilateral lobe or the contralateral lung. Frequently at operation when one sets out to perform lobectomy it is found that nodules, not recognizable in the X-ray films, are present in the lobe that is to be left. Overholt believes that the presence of these nodules contraindicates lobectomy and that one should proceed at once to pneumonectomy because the risk of spread in the remaining lobe is very high. In one of our cases we removed a left lower lobe which was collapsed behind a stenosed bronchus, and to do this had to transect an actively tuberculous stem bronchus. At operation nodules could be felt in the lingula, but, despite this, the upper lobe was not removed because we were uncertain of the stability of an old lesion in the right upper lobe. A serious exacerbation occurred in the lingular segment, and although it eventually responded to bed rest and phrenic paralysis, I think pneumonectomy would have been safer. Spread of disease may occur in the early post-operative period, and when this happens it should be attributed to the operation. It may occur when all disturbance from the operation appears to have subsided and may not then be due entirely to the operation. In many of the cases selected for resection it must be recognized that sooner or later, without operation, spread is inevitable and the death rate amongst these patients would be high, and I think it is unfair to load the case against resection by laying these late spreads at its door.

Ulceration of the Bronchial Stump.—Active bronchial disease is present in many of the cases selected for resection. Sometimes it is obvious that transection of the bronchus must be made through active tuberculous tissue. Even though the bronchus may appear healthy at the site of division, microscopic examination may show that it is in fact infected. Despite this, the stump will usually heal without difficulty; but it is not surprising that ulceration sometimes develops in it, and this may be a source of persistently "positive" sputum.

In Overholt's 200 cases only two cases of ulceration of the bronchial stump were reported; but he points out that this figure is not significant because many of the ulcers become evident only after the post-operative period and fall into the late complications. Bronchoscopy should always be carried out in any case in which an unexplained "positive" sputum is present.

The technique of resection for pulmonary tuberculosis presents no special difficulties. Frequently these patients have a large volume of tuberculous sputum, and Overholt's face-down position is probably of real value in reducing the risk of spread from overflow of this sputum into the contralateral lung. For pneumonectomy the use of an endobronchial tube on the good side is worth while, especially if the right lung is to be resected, because the left stem bronchus is more adapted to the use of an endobronchial tube than is the right one. Frequent aspiration of secretion throughout the operation and post-operative bronchoscopy should never be neglected. Often the lung over a thick-walled cavity will be inseparably fused to the chest wall, and separation may be tedious and time-consuming and may have to be carried out in the extrapleural plane. Where there has been extensive pleural infection this dense fusion may extend over a considerable area. Once the pedicle is reached it is usually found that the bronchus and vessels are easily separated. Bronchial

closure must be meticulous and the surgeon must never be hurried. We use cyclopropane anaesthesia supplemented with "Pentothal" and curare with controlled respiration, and the patient receives a continuous drip transfusion throughout the operation and is given as much blood as is necessary to maintain his condition. With the indications that we at present accept, pneumonectomy is required more often than lobectomy. Segmental resection may occasionally be applicable for sharply localized lesions, but only if it seems certain that the tuberculous involvement is limited to the segment to be resected. Where thoracoplasty has previously been performed and regenerated rib has to be resected to enter the chest, this part of the operation is often extremely difficult and time-consuming.

Following lobectomy the pleural cavity may or may not be drained according to the practice of the surgeon concerned; our own practice is always to use closed drainage following lobectomy. After pneumonectomy drainage is better avoided and in the post-operative period the mediastinum should be maintained in a central position by repeated aspiration of air or fluid as may be required. For patients who have had a previous thoracoplasty it is our practice to drain the pleural cavity, even after pneumonectomy, because it is found that there is frequently a good deal of oozing, and because of the small size of the pleural space small amounts of effusion are likely to cause considerable mediastinal displacement, and for the same reason aspiration of the space is difficult and often unsatisfactory. If resection ever becomes a method of election for treating early localized disease, it is obvious that lobectomy will become a much more frequent operation.

Streptomycin.

Streptomycin is of value in controlling laryngeal and tracheo-bronchial tuberculosis and for patients with recent disease. In cases of laryngeal tuberculosis or tracheo-bronchial disease we feel that it is reasonable to administer streptomycin for a period of three weeks to four weeks before operation and to continue its use after operation, and we feel that it should be of value in preventing early post-operative spread or reactivation. Clagett has reported its use as a prophylactic in 13 cases and obtained encouraging results. Streptomycin has been available to us for about the last year and we have used it to cover two lobectomies and six pneumonectomies in the last nine months. From four of the pneumonectomies and both of the lobectomies the patients recovered without incident and are doing well; two pneumonectomies are too recent for consideration. In three of these cases streptomycin was used for only twenty-four hours before operation and for ten to fifteen days after operation with a view to protecting patients whose condition was stable from the risk of spread during the immediate post-operative period. The other four patients were febrile with active disease at the time of operation and were treated with streptomycin intramuscularly for from three to six weeks before operation and during the post-operative period until a total of 60.0 grammes had been administered. It is our practice to give one gramme daily in two equal doses, and in some cases we have increased the dose to two grammes daily for a few days immediately after the operation.¹

Personal Experience.

My own experience is limited to eleven pneumonectomies (Table I) and seven lobectomies (Table II).

One patient died on the fifteenth day after pneumonectomy from gross spread in the contralateral lung. Two pneumonectomies must be excluded from consideration because the operations have been too recently done. Another patient, G.E., died six months after pneumonectomy from malignant hypertension with no evidence of activity in her remaining lung.

I.S. had a pneumonectomy for a lower lobe cavity persisting after thoracoplasty and developed a small empyema; a bronchial fistula formed two months after operation. The empyema was drained and closed except for a small sinus leading into a minute pocket in front of the lower ribs which had not been resected and the fistula closed. Recently this small pocket was unroofed and is now healing satisfactorily.

¹ Since the presentation of this paper we have reduced the dose of streptomycin to 0.25 gramme twice daily.

TABLE I.
Summary of Patients Treated by Pneumonectomy.

Patient.	Age.	Sex.	Date of Operation.	Indication for Operation.	Fever.	Sputum Before Operation.	Complications.	Sputum After Operation.	Present Status.
G.J. ..	28	F.	17.6.45	Bronchostenosis with copious foul sputum.	Slight.	Positive.	Post-operative spread.	Positive.	Death on fifteenth day.
A.J.B.	3	M.	10.8.46	Bronchostenosis. Hemoptysis. ? Carcinoma.	No.	Negative.	Nil.	Negative.	Well and at work.
G.E. ..	30	F.	30.8.46	Lower lobe cavity not controlled in two years by other methods.	No.	Positive.	Nil.	Negative.	Death. Malignant hypertension six months later. Post-mortem no active disease.
I.S. ..	30	F.	11.2.47	Lower lobe cavity persisting after thoracoplasty.	No.	Positive.	Tuberculous empyema with fistula.	Negative.	Well. Fistula closed.
A.M. ..	65	M.	22.9.47	Tuberculoma. Diagnosed carcinoma.	No.	Negative.	Nil.	Negative.	Well. At work.
H.C.O.	34	F.	2.12.47	Bronchostenosis. Opaque lung.	No.	Positive.	Nil.	Negative.	Well. Post-operative thoracoplasty.
M.H. ..	22	F.	13.12.47	Destroyed lung with cavities in upper and lower lobes.	Yes.	Positive.	Nil.	Negative.	Well. Still in sanatorium.
J.McC.	22	F.	23.3.48	Bronchostenosis with opaque lung and cavitation.	Yes.	Positive.	? Reactivation of small focus in contralateral lung.	Negative.	Still in sanatorium.
A.H. ..	42	F.	4.5.48	Bronchostenosis with opaque lung and cavitation and laryngeal tuberculosis.	Yes.	Positive.	Nil.	Negative.	Still in sanatorium.
E.E.	31	F.	8.6.48	Contracted destroyed lung with cavitation. Bronchostenosis.	Yes.	Positive.		Negative.	
A.L. ..	47	M.	22.6.48	Contracted destroyed lung with cavitation and repeated massive hemorrhage. Bronchostenosis.	No.	Positive.			Sudden death third day. Post-mortem, old rheumatic disease of heart, carcinoma of kidney.

TABLE II.
Summary of Patients Treated by Lobectomy.

Patient.	Age.	Sex.	Date of Operation.	Indication for Operation.	Fever.	Sputum Before Operation.	Complications.	Sputum After Operation.	Present Status.
B.T. ..	—	F.	6.7.46	Tuberculoma of right lower lobe.	No.	Positive.	Ulceration of stump and spread in middle lobe six months after operation.	Positive.	Very well. Apparently quiescent. Sputum negative.
N.McD.	24	F.	20.7.46	Cavity of right upper lobe not closed by thoracoplasty.	No.	Positive.	Nil.	Negative.	Very well. Married and working.
J.K. ..	39	F.	10.9.46	Bronchial disease of left side with stenosis left lower lobe bronchus.	No.	Positive.	Acute spread in lingula.	Positive.	Very well.
F.McN.	35	M.	17.2.47	Tuberculoma left upper lobe.	No.	Negative.	Nil.	Negative.	Very well.
M.B. ..	29	F.	9.3.48	Tuberculoma right lower lobe.	No.	Negative.	Nil.	Negative.	Very well.
T. ..	40	F.	30.3.48	Bronchiectasis right upper lobe recurring hemoptysis for 20 years.	No.	Positive culture after bronchoscopy.	Nil.	Negative.	Very well.
C.B. ..	42	M.	15.5.48	Tuberculoma right upper lobe.	No.	Negative.	Nil.	Negative.	Very well.

In this patient, at operation, the cavity was inseparably fused to the chest wall and the lung was removed by tearing through this cavity and leaving tuberculous tissue adherent to the chest wall, so that it is not surprising that an empyema developed.

Another patient, J. McC., who had a pneumonectomy, has a small quiescent lesion in her right lung, and although she is very well there is some suspicion that the radiographs show some slight reactivation in this lesion.

Miss B.T. had her right lower lobe removed because it contained a tuberculoma which had broken down and had resisted other forms of treatment over a year. She was completely well for six months with "negative" sputum; then she developed a cold and her sputum became "positive"; a small area of activity was found in the middle lobe of her right lung and bronchoscopy demonstrated some ulceration in her bronchial stump and around the right middle lobe orifice. She has been at rest in hospital for the last fifteen months and her condition now appears to be quiescent.

Miss J.K. was under observation for several years with stenosis of the bronchus leading to the collapsed lower lobe of her left lung. She suffered from recurring mild febrile episodes during which her sputum became positive. There was some delay in deciding on lobectomy, and during this interval the bronchial disease spread through the left stem bronchus until it extended above the level of the left

upper lobe orifice. There was a doubtful lesion in her right upper lobe, and although at operation tuberculous nodules were felt in the lingula lobectomy was performed. The lingula disease became acutely reactivated in the post-operative period and her convalescence was stormy. With bed rest and phrenic paralysis she recovered and her condition is now very satisfactory.

To summarize our experience, we have performed 18 resections for pulmonary tuberculosis. One patient died as a result of the operation and another one died six months after operation of malignant hypertension, and at autopsy it appeared that her tuberculosis was healed. Thirteen of the patients had "positive sputum" before operation, and at the present time the sputum of all the survivors is "negative"; two patients must be excluded because their operations are too recent for the results to be assessed.

Conclusions.

1. Resection has established itself as a valuable treatment in certain forms of pulmonary tuberculosis.
2. It is not an alternative to thoracoplasty, but should be used for cases in which thoracoplasty is inapplicable or has failed.

3. Most of the patients selected for resection have no other chance of getting well, and the undoubted risks are justified by the successes.

4. Streptomycin is probably of real value to cover the immediate post-operative period and to control post-operative spread.

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ANÆSTHESIA IN THE SURGICAL TREATMENT OF PULMONARY TUBERCULOSIS.¹

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DURING recent years, the physician's approach to the problems of pulmonary tuberculosis has changed. Prior to the present surgical era, the main principle in treatment was that of resting the diseased areas of lung tissue by such methods as artificial pneumothorax and phrenic crush. No great demands were made upon the skill of the surgeon or the anæsthetist. Thoracoplasty, with its aim of cavity closure, brought the surgeon more prominently into the field of treatment, but he hesitated to use general anaesthesia. Improvement in anaesthetic methods and agents, however, soon allowed its use in these cases without added risk to the patients. Finally, the principle of extirpating grossly diseased areas of pulmonary tissue was introduced and the surgeon was called upon to perform major intrathoracic operations upon tuberculous patients. Once more some surgeons preferred to employ local anaesthesia upon the mistaken idea that general anaesthesia carried extra risks for the patients. Fallacious arguments and very doubtful statistics were produced by at least one surgeon to justify the use of local anaesthesia. Fortunately for the majority of patients, most surgeons realized that the risks of performing major intrathoracic operations under local anaesthesia were far greater than under general anaesthesia, so that the latter has come to be accepted as the method of choice in these cases.

Two of the great problems in the surgical treatment of pulmonary tuberculosis are those of preventing the spread of infection from diseased to healthy areas of lung and of avoiding activation of the minimal lesions that are invariably scattered throughout both lungs of these patients. At times it is difficult to distinguish between these com-

plications of surgery, and, though the end results may be similar, the pathogenesis are very different. The prevention of the former largely lies within the province of the anæsthetist whilst the avoidance of the latter rests within the scope of the physician and the surgeon. Even here, however, the anæsthetist must accept his share of the responsibility.

Control of Secretions.

In operations upon the chest wall, such as thoracoplasty, secretions usually do not present any great problem and endotracheal methods are rarely essential. The position is very different when the surgeon enters the thorax and embarks upon pulmonary resection. If active steps are not taken to minimize the effects of excessive secretions, spread of infection to healthy areas of lung is likely to occur, with serious consequences to the patient. The control of these secretions must commence in the pre-operative period when postural coughing should be encouraged. Unfortunately, chemotherapy is not as effective in reducing the secretions in the tuberculous patient as it is in the bronchiectatic. In some cases, when streptomycin has been administered for some weeks prior to operation, the volume of sputum has fallen. Penicillin aerosol has little value and indeed in some cases appears to increase the secretions. Routine pre-operative bronchoscopy, except to determine the extent of the bronchial disease, is undesirable and the incidence of spread following bronchoscopy is by no means negligible. Over the last two years we have performed bronchoscopies on tuberculous patients under a combination of "Pentothal Sodium" anaesthesia and "Tubarine". This prevents coughing during passage of the bronchoscope and reduces the risk of spill.

During operation, the secretions are controlled by three main methods. Firstly, the direction of flow may be regulated by the posture of the patient on the operating table. It is usual to perform thoracic operations with the patient in the lateral position, with the diseased lung uppermost, so that secretions tend to gravitate into the healthy lung. If the operating table is tilted into a head-down position, secretions can be prevented from entering the underneath lung, but the angle of tilt is such as to embarrass the surgeon. The angle varies according to the side upon which the patient is lying owing to the anatomy of the bronchial tree. For a right-sided operation it is necessary to tilt the table until it makes an angle of at least 55° to the horizontal, whilst for a left side the angle must be at least 35°.

Overholt introduced the prone position which avoids the need for a steep head-down tilt. It requires a special frame to support the patient, but provided the anæsthetist employs an endotracheal catheter not fitted with an inflatable cuff, the secretions will gravitate through the larynx and into the pharynx. When endobronchial and occlusion methods are not possible, the prone position offers a very valuable aid in the control of secretions.

The second method used to control secretions is by suction applied to the bronchial tree via the endotracheal catheter. A urethral catheter of sufficient length to pass well beyond the bifurcation of the trachea is passed by the anæsthetist through the lumen of the endotracheal catheter and suction applied. This manoeuvre must be performed at regular intervals, particularly when the lung is handled by the surgeon.

The third method is that of occlusion so that the diseased area of lung is shut off from the remainder of the lung tissue into which the anaesthetic is delivered. In its simplest form, this consists of one-lung anaesthesia, the diseased lung being occluded whilst the anaesthetic is delivered into the sound lung. Endobronchial anaesthesia has certain difficulties and disadvantages. Owing to the anatomical arrangement of the main bronchi, a catheter passed blindly down the trachea will enter the right bronchus on most occasions, making blind right bronchial intubation relatively easy. Unless special precautions are taken, however, such intubation will lead to obstruction of the right upper lobe bronchus and atelectasis of the lobe supplied by it. On the left side, where the same danger does not exist, bronchial intubation requires the use of a bronchoscope by the anæsthetist. If the anæ-

¹Read at a meeting of the Sections of Anaesthesia, Surgery, and Public Health, Tuberculosis and Tropical Medicine, Australasian Medical Congress (British Medical Association), Sixth Session, Perth, August, 1948.

thetist is trained in the use of the bronchoscope then endobronchial anaesthesia can be used with advantage, but its use must be limited to those cases in which pneumonectomy is contemplated.

More complicated methods of occlusion applicable to the operation of lobectomy consist in introducing either tampons or balloons into the particular bronchus which supplies the diseased lobe of the lung. These methods require extensive endobronchial manipulations for the accurate placement of the balloon, and retention at the selected site throughout a long operation is difficult. It is only necessary to note the very numerous methods that have been devised to realize that no entirely satisfactory method is available.

After operation, pulmonary secretions still require careful attention. There is considerable difference of opinion as to the necessity of performing bronchoscopy at the termination of the operation. Until recently, I did not make a routine procedure of passing a bronchoscope after the removal of the endotracheal catheter. Now, however, I do so and I have been surprised at times at the amount of secretions still present in the bronchial tree. Many writers point out the danger of passing the bronchoscope under very light anaesthesia owing to the risk of cardiac arrest. It is my practice to allow the patient to become almost conscious towards the end of the operation and then when he has been turned on to his back, to administer a small amount (approximately 0.1 gramme) of "Pentothal Sodium". This produces transient anaesthesia of sufficient depth to allow the safe introduction of the bronchoscope, but the cough reflex rapidly returns and allows the bronchoscopy to be adequately performed. During the post-operative period, it should be the anaesthetist's duty to be certain that atelectasis does not develop. When the patient is failing to bring up his secretions, tracheo-bronchial suction should be performed. Many patients are capable of coughing their secretions as high as the trachea, but find it impossible to expel them through the larynx. In these cases, the introduction of a suction catheter into the trachea does much to clear the bronchial tree. When tracheal suction fails to relieve the patient and if radiological signs of atelectasis persist, then bronchoscopy should be performed. This is best done either under local anaesthesia alone or under local anaesthesia and "Pentothal Sodium", sufficient of the latter being given to abolish consciousness and no more. For the satisfactory performance of a post-operative bronchoscopy an active cough reflex should be present. It is unusual to find a bronchial plug at such a bronchoscopy but rather secretions are seen running from the bronchial orifices. Under those conditions the greatest value of the bronchoscopy is the forceful coughing that it provokes.

Anoxia and Atelectasis.

Second only to the spill of secretions in the production of post-operative spread of infection is the occurrence of anoxia during anaesthesia. This is the greatest argument against the use of local anaesthesia for major thoracic surgery, as with this form of anaesthesia it is frequently impossible to avoid anoxia as the result of paradoxical respiration and mediastinal "flap". Both these conditions will occur during operations involving an open thorax or the removal of the bony thorax; that is to say, during thoracotomy or thoracoplasty. Oxygen administration alone will not combat anoxia from these causes—controlled respiration is essential and this is impossible with a conscious patient and local anaesthesia.

Why is anoxia damaging to these patients and why does it aid the spread of infection? It must be remembered that the only oxygen to reach the endothelium lining the capillaries of the pulmonary alveoli is that carried to the alveoli in the gases inhaled during inspiration. The blood passing through the pulmonary capillaries is venous and incapable of supplying the oxygen requirements of the vessel walls. Should the alveolar atmosphere be deficient in oxygen, then anoxia of the endothelium must result. Drinker has demonstrated that if the endothelium of the pulmonary capillaries is rendered anoxic, toxic spoiling occurs and the capillaries become abnormally permeable to the protein constituents of the blood passing

through them. There is an out-pouring of oedema fluid into the pulmonary alveoli and the alveolar pores or lateral communications become blocked, so that collateral ventilation ceases.

In a healthy subject, should bronchial secretions enter a secondary bronchus and obstruct it, air continues to enter the alveoli distal to the block through the lateral communications and the patient is able to expel the secretions. No lobular atelectasis occurs. This applies equally to the patient who has been subjected to surgery and in whom all forms of anoxia have been strictly avoided. On the other hand, should anoxia of the pulmonary endothelium have developed, then oedema fluid will enter the alveoli and obstruct the lateral communications. Now, when a bronchus becomes obstructed by secretions no air will be able to enter the alveoli distal to the obstruction, the air already present will undergo absorption and the segment of lung supplied by that particular bronchus will become atelectatic. This in turn leads to more severe anoxia of the endothelium and further accumulation of fluid within the alveoli. Infection spreads from the bronchial plug to the atelectatic area and an area of tuberculous bronchopneumonia is established. It is thus seen that the sequence of events in post-operative spread of infection commences during anaesthesia with anoxia of areas of lung tissue. This anoxia may be caused by inadequate oxygen content of the anaesthetic mixture as with nitrous oxide anaesthesia, by diminished tidal respiration and inadequate expansion of peripheral parts of the lungs as the result of excessive premedication and local anaesthesia, or by the occurrence of paradoxical respiration during voluntary breathing, whether under local or general anaesthesia. Finally it may be caused by histotoxic anoxia arising from excessive depth of anaesthesia. Once anoxia has been present for any length of time during operation, it only needs secretions to occlude a bronchus for lobular atelectasis to occur. With non-tuberculous infections, the invasion of the atelectatic area can be controlled by chemotherapy. Until recently such control was not possible with the tuberculous patient. Now, however, with streptomycin we have in our hands an agent that is of great value in the control of spread. If streptomycin is administered for a short period before operation and if the administration is continued in the post-operative period, then any oedema fluid that is poured into the alveoli is likely to contain a concentration of streptomycin adequate to prevent the invasion of the oedema fluid by the tubercle bacilli.

Conclusion.

It is thus seen that the two most important facts for the anaesthetist in surgery of pulmonary tuberculosis are that secretions must be controlled and that all forms of anoxia must be avoided if spread of tuberculous infection is to be prevented.

ANÆSTHESIA IN THE SURGICAL TREATMENT OF PULMONARY TUBERCULOSIS.¹

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THE majority of patients who come to the thoracic surgeon have a serious limitation of vital capacity and the involvement of the lung may greatly diminish the surface available for respiratory exchange. Cough and sputum may be present, tending to cause obstruction of the respiratory passages or spread of the disease to the healthy lung. The operation to be performed may vary in magnitude from bronchoscopy to pneumonectomy. The scope of operation appears to be increasing. Bailey² reported 80 lung resections for pulmonary tuberculosis in four years. However, the general principles of anaesthesia

¹ Read at a combined meeting of the Section of Surgery, the Section of Anaesthesia and the Section of Public Health, Tuberculosis and Tropical Medicine, Australasian Medical Congress (British Medical Association), Sixth Session, Perth, August, 1948.

are the same, and they should be carried out with meticulous care or the result may be an exacerbation of the disease or even the death of the patient.

Essentials for Satisfactory Anaesthesia.

The following are essential for satisfactory anaesthesia:

1. The agent or agents should be such as to cause no irritation or damage to the lungs.
2. The drug should not lower or raise the blood pressure to any pronounced degree.
3. The method employed should ensure an unobstructed airway and adequate oxygenation of the patient's tissues.
4. Means of efficient elimination of carbon dioxide must be provided.
5. Removal of infected secretions must be possible at all times.
6. The method must allow anaesthesia to be prolonged should an extension of the operation demand it.
7. Recovery of cough reflex and consciousness should be rapid after operation.
8. Post-operative atelectasis should be avoided.

Analysis of the Present Records.

Before preparing this paper I analysed 20,519 of my own anaesthetic records. Among these 20,519 cases were 537 in which the patients were suffering from pulmonary tuberculosis. Although these numbers are too small to be of real statistical value, the records show the gradual change in technique of anaesthesia and the reasons for the change. The agents first recorded were chloroform^(a) and ether; a change was then made to nitrous oxide and oxygen. Following this, by way of ethylene,^(b) came spinal analgesia and, later still, intravenous anaesthesia; then cyclopropane, trichlorethylene, and finally cyclopropane in combination with curare and "Sodium Pentothal" given intravenously.

Choice of Method.

The reasons for the choice of anaesthetic method are best shown by an enumeration of the different methods with their advantages and disadvantages.

Premedication.

Heavy premedication is unnecessary and undesirable in thoracic surgery, in which it is required that the patient shall be awake and capable of coughing as soon after the termination of the operation as possible.^(c) It has been found that heavy premedication tends to increase the risk of post-operative pulmonary complications. Lamphee^(d) reported a series of 52 patients suffering from pulmonary tuberculosis upon whom thoracic operations were performed under gaseous anaesthesia. In this series five patients were given paraldehyde as premedication. In all these five cases there were post-operative signs of local spread within two days, and two of the patients died within ten days. In none of the other 47 cases was there an exacerbation of the disease.

Spinal Analgesia.

The advantages of spinal analgesia^{(e)(f)(g)} are said to be that consciousness is retained, which allows the cooperation of the patient and does not inhibit the cough reflex. The disadvantages on the other hand are numerous. Heavy premedication is required.^(h) There is the possibility of a big fall of blood pressure. Spinal analgesia is unsuitable when the systolic blood pressure is below 100 millimetres of mercury. Hypoxia is not infrequent, and inadequate ventilation is an important predisposing factor to the occurrence of post-operative pulmonary collapse and other chest complications. The duration of analgesia may be insufficient, and general anaesthesia may be required to complete the operation. Mediastinal "flap" may occur when the thorax is open and the mediastinum is mobile.

Local Analgesia.

Local analgesia is recommended by Overholt,⁽ⁱ⁾ who claims that when it is used there is no shock and the cough reflex is retained. This has been refuted by

Orton.^(j) The first of the disadvantages is the factor of psychic strain and shock. Decker^(k) makes the following statement: "A patient may stand one operation well with local anaesthesia, but when called upon to undergo a second or third, is considerably upset mentally and nervously." Churchill^(l) teaches that "effective cough requires a tight chest wall so that a high intrathoracic pressure can be built up Cough has a spreading as well as an expulsive action." In this method, as with spinal analgesia, heavy premedication is essential. However, local analgesia is suitable for short extrapleural operations.

General Anaesthesia.

General anaesthesia has numerous advantages. (i) The patient is unconscious, fear and psychic shock being lessened. (ii) Ample oxygen can be supplied. (iii) Light anaesthesia is possible. (iv) There is a rapid recovery of consciousness and the cough reflex. (v) Intubation is easy and without discomfort. (vi) Secretions may be removed at any time. (vii) Anaesthesia may be maintained for operations of variable length. (viii) Mediastinal movement can be controlled.

Choice of Anaesthetic Agent.

Ether.

Ether is irritating to the respiratory mucous membranes; it may provoke coughing, salivation and the secretion of mucus. Anaesthetists generally consider ether to be unsuitable for patients suffering from pulmonary tuberculosis either as the chief agent or as an adjuvant to the gaseous anaesthetics. Recovery of consciousness is prolonged and frequently followed by vomiting. Specialists in tuberculosis agree that pulmonary tuberculosis frequently appears shortly after an operation under ether anaesthesia; or if the disease is already present, an exacerbation may follow.

Beecher and Churchill^(m) appear to be almost the sole advocates for ether; they state that "the irritating quality of ether is not important in morbidity or mortality".

I consider that ether should not be used at all in pulmonary tuberculosis.

Barbiturates Given Intravenously.

"Pentothal Sodium" alone is suitable only for minor procedures, such as paracentesis. It may be used with advantage for induction of anaesthesia which is to be maintained by one of the gaseous anaesthetics.

"Kemithal" with curare has been used by Halton^{(n)(o)} for lung lobectomy and pneumonectomy, under "controlled respiration" with oxygen alone. However, he advises changing to cyclopropane if the operation is of long duration or the dose of "Kemithal" is high.

Trichlorethylene.

Trichlorethylene alone is unsatisfactory, as relaxation is poor and tachypnoea is not infrequent. Trichlorethylene cannot be used with carbon dioxide absorption technique, as it may combine with the soda lime to produce phosgene and dichloroacetylene. The latter is explosive and is capable of producing herpes, cerebral nerve palsies and even death from bulbar paralysis.^(p)

The Gaseous Anaesthetics.

The gaseous anaesthetics have the following advantages. The introduction is rapid and pleasant. They cause no irritation or damage to the lungs. They are non-toxic so long as oxygenation is ample. Anaesthesia may be maintained for operations of any length. The blood pressure is unaltered. Recovery of consciousness and cough reflex is rapid and vomiting or nausea is minimal. However, nitrous oxide may not permit a sufficient percentage of oxygen unless heavy premedication is used. Muscular relaxation is poor.

Cyclopropane at present appears to be the ideal anaesthetic for thoracic surgery. It does not stimulate respiration and it allows the proportion of oxygen to be 85% or higher. Recovery is rapid, while nausea and vomiting

are usually absent or slight. Cyclopropane is inflammable and explosive when mixed with oxygen, so cannot be used where diathermy is required.

Curare.

Curare, although not itself an anæsthetic, is probably the most valuable aid to anæsthesia for thoracic surgery in pulmonary tuberculosis. It has the following advantages. (a) It paralyzes skeletal muscle, producing relaxation with light-plane anæsthesia. This assists in early recovery of consciousness, in comparative freedom from shock, and in reduction of post-operative complications. (b) It paralyzes the diaphragm, producing a quiet field of operation for the surgeon. (c) It abolishes the laryngeal and bronchial reflexes. (d) It allows aspiration of secretions without any reaction or spasm. (e) With it controlled respiration is possible without deep anæsthesia or heavy premedication.

Idiosyncrasy to Curare.

Halton⁽¹⁸⁾ has encountered two cases of idiosyncrasy to curare; one of the patients died. Gray recommends a test dose amounting to one-third of the calculated induction dose. This is followed by a pause of three minutes, by which time the patient feels drowsy and has weakness of the eye muscles, but no embarrassment of the respiratory function.

Choice of Technique.

Cyclopropane Given by a Mask.—Cyclopropane with carbon dioxide absorption may be given with a mask when secretions are absent. This method is also used for thoracoplasty by some anæsthetists who fear that an endotracheal tube may tend to cause irritation and infection of the larynx.

Cyclopropane Given by Endotracheal Tube.—An endotracheal tube will provide instantaneous, and at times life-saving, bronchial aspiration.

Cyclopropane Given by Endobronchial Tube.—Endobronchial anæsthesia may be employed with advantage in right-sided pneumonectomy. It is a specialized procedure and should not be undertaken by any worker unacquainted with bronchoscopic technique and with the administration of cyclopropane by the methods of controlled respiration.⁽¹⁹⁾

Cyclopropane with Controlled Respiration.—The principle of controlled respiration, suggested by Nosworthy,⁽²⁰⁾ has been of the utmost use to the thoracic surgeon. The carbon dioxide threshold of the respiratory centre is raised with premedication and with "Pentothal Sodium", anæsthesia is maintained with a small amount of cyclopropane, and the bronchial reflexes are controlled with curare. This provides a condition of absolute muscular rest, mediastinal "flap" is obviated when the thorax is opened, and the surgical access to the lung or diaphragm can be facilitated by temporary cessation of lung inflation. Controlled respiration is essential for the major thoracic operations and when curare is used.

Technique of Anæsthesia for Lobectomy or Pneumonectomy.

As the more extensive and serious of these pulmonary operations have been infrequently performed in Australia as yet, the following suggestions are made as to technique of anæsthesia for lobectomy or pneumonectomy for pulmonary tuberculosis. I wish to acknowledge my indebtedness to Dr. Robert Orton, on whose teaching this section is based.⁽²⁰⁾⁽²¹⁾⁽²²⁾

General Considerations.

In order to obtain satisfactory results in these operations, anæsthetist and surgeon must cooperate closely. A blood transfusion should be started and be working evenly before anæsthesia is begun. The anæsthetist must have ample time to induce anæsthesia and to reach a proper level of maintenance; this period may be half an hour or more—there must be no hurry. An efficient suction apparatus must be available for the sole use of the anæsthetist.

Premedication.

Morphine ($\frac{1}{100}$ grain) with hyoscine ($\frac{1}{1000}$ grain) per stone of body weight should be given not less than one hour beforehand.

Induction.

"Tubarine" (d-tubocurarine chloride) in the dosage of 0.1 milligramme per pound of body weight is used for induction. One-third of this dose is given to the conscious patient through the transfusion drip tube and a pause of three minutes is made before the remainder is injected. The drip should be flowing quickly in order to obtain rapid absorption. The "Tubarine" is immediately followed by a 5% solution of "Pentothal Sodium", given in divided doses, until consciousness is lost. The average dose for an adult patient is 0.5 gramme.

Laryngeal Intubation.

The larynx is intubated through the mouth with a large cuffed tube. A suction catheter is passed through the endotracheal tube and secretions are removed from the bronchial tree. The tube is then connected, by a Cobb's elbow, to the anæsthetic apparatus with the carbon dioxide absorber in circuit.

Maintenance of Anæsthesia.

The lungs are inflated rhythmically by pressure on the bag at about twenty times a minute, a mixture containing 15% of cyclopropane being used. The oxygen percentage may be gradually increased until there is evidence of too light anæsthesia, signs of which are rising blood pressure and pulse rate and spasmodic contraction of the diaphragm. The appearance of these signs calls for a slight deepening of anæsthesia. Suction must be performed at frequent intervals, as the usual signs of the presence of secretions will no longer be evident.

The initial dose of curare abolishes the bronchial reflexes for twenty to thirty minutes, after which period about one-third of the original dose will need to be given at intervals of twenty to thirty minutes. Orton's tests for absence of the bronchial reflexes are as follows: (i) to pass the suction catheter into the bronchial tree without provoking any reaction, and (ii) to squeeze the pilot balloon, which causes further distension of the cuff without ensuing spasm. Over-ventilation must be guarded against by noting the time which will elapse between cessation of inflation and the return of spontaneous respiration. If this time is more than thirty seconds, the degree of inflation should be reduced with each pressure on the bag.

Termination of Control.

The method of termination of controlled respiration has an influence not only on the immediate welfare of the patient, but also on the possibility of atelectasis at a later date. Firstly, curare should not be given within forty-five minutes of the termination of the operation, otherwise there may be absence of intercostal respiration. The anæsthetist then has the choice of the undignified continuance of control long after the operation has been completed, or the necessity of giving an injection of three to five milligrammes of "Prostigmin" followed by an injection of one-fiftieth of a grain of atropine. Secondly, when spontaneous respiration has been resumed, a change should be made to nitrous oxide and oxygen given by continuous flow. This manœuvre will decrease the percentage of oxygen in the mixture and so lessen the possibility of massive collapse of the lung.

Conclusions.

1. Cyclopropane and oxygen anæsthesia is the most generally useful.
2. Curare is a most valuable aid to anæsthesia in these operations.
3. Controlled respiration is essential for the major operations.
4. Spinal and local analgesia have a very limited field of usefulness.
5. Ether should not be employed either as the main anæsthetic or as an adjuvant to the gaseous anæsthetics.
6. Heavy premedication is unnecessary and dangerous.

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THE LIMITATIONS OF THE ROLE OF THE RADIOLOGIST IN THE DIAGNOSIS OF PULMONARY TUBERCULOSIS.¹

By KEITH H. HALLAM,
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I THANK you for the honour you have conferred on me by inviting me to make a radiological contribution to this design for the control and elimination of pulmonary tuberculosis. The value of radiology in such a design is generally accepted, and Röntgen must be ranged alongside other great figures in the fight against this disease. My intention is to present to you the salient features of the use of X rays in disclosing cases of pulmonary tuberculosis. To the best of my ability I shall refrain from submerging you in a morass of technology, statistics and, in particular, the ideological fads of our specialty, but will try to make you "see the object as in itself it really is".

No other specialty in the practice of medicine is policed so strictly by other medical practitioners as is radiology. The opinions of radiologists must be restricted to short written reports, and we cannot dilute them with a spate of spoken words. Likewise we must produce our films as evidence: evidence from other laboratories may be evanescent or poured down the drain. This radiological open house is all for the best because our evidence has not the

finite quality of bacteriological and biochemical methods. Camouflage might indeed have been invented as the special requisite of infections of the lungs: their elusiveness and pseudomorphism are well known to you all. The details of the limitations of X-ray examinations may, however, not be clear in your minds, and in any campaign it is well that all units should know just what are the functions of any single unit.

Whenever one encounters an evil thing two objectives are sought: one is to restrict the scope and influence of the evil thing and the other is to eliminate the evil thing itself. One must separately, but concurrently, combat and limit the spread of a large city or bush fire. Like methods are used against infectious diseases. In limiting the spread of pulmonary tuberculosis, and in the direct fight against it, radiology plays two different parts with varying limitations.

The prime factors in limiting the spread of tuberculosis are improvement in social conditions and the detection of those suffering from the disease. While recognizing the importance of the former, I stress the latter, as it can be effected quickly and cheaply by chest X-ray surveys in which, although the use of X rays is unlimited, the role of the radiologist has limitations. Whether microfilms (varying in size from 35 millimetres to 5 inches by 4 inches), or 14-inch by 17-inch films are used, these come to the radiologist out of the blue without any clinical background.

The duty of the radiologist is to select from these films, large or small, those of examinees who may possibly be suffering from tuberculosis or other pathological conditions of the thorax. When microfilms are used the radiologist is limited simply to sorting out examinees who may be suffering from disease from those who appear to be free of disease. Nothing more, nothing less. He is merely a skirmisher; but he is the first medical quantum used in the sum of attackers and his role is an important one. There is great danger in the radiologist's trying to gain too much information from the meagre evidence presented, and on no account should anyone who might on clinical grounds be suffering from pulmonary tuberculosis submit himself to examination by a microfilm: the large films should be used without fail in such a case. So dangerous is the micro-method if not properly handled that the highest standards of meticulous care in the production of films, and in the reading of them, are demanded. Overreading and underreading (that is, suspecting too much or too little) are well known to experienced readers, and all batches of films should be read independently by two skilled radiologists. Large films are taken of all examinees whom the radiologists suspect of having thoracic lesions. Here, again, in the reading of these the scope of the radiologist is limited, as he makes only a small step towards precision. He may suggest that some examinees may be tuberculous or state that some are probably suffering from pulmonary tuberculosis. Here his work ends: he has not seen one examinee, or history, or had one consultation with a colleague. There have been no patients.

In 14-inch by 17-inch film surveys of groups—such as applicants for training as nurses, or for employment in banking, insurance, or industrial organizations—the radiologist has a higher place as a medical practitioner. In the best types of surveys, such as those of nursing trainees, concurrent Mantoux tests, maybe films of the nasal sinuses and personal access to supervising physicians for consultation enlarge his scope for expressing a less vague opinion. His medical training begins to emerge from its celluloid chrysalis. The point I stress is that in chest surveys the role of the radiologist is the most important one, but he has a limited opportunity for expressing himself as a physician.

The part of the radiologist in the elimination of the disease itself is the detection of infection in subjects clinically suspected of suffering from pulmonary tuberculosis, and the X-ray supervision of known subjects. Here he enters the lists to display some medical ringcraft. There was an ante-bellum period when radiologists "screened" all patients sent for chest X-ray examination and took an appropriate history, but war conditions pre-

¹Read at the Plenary Session of the Australasian Medical Congress (British Medical Association), Sixth Session, Perth, August, 1948.

cluded the service and civilian radiologists from doing this. We hope that some day the overtaking of the demand for radiologists by the supply will enable us to resume this practice.

In his Mathison Memorial Lecture delivered in Melbourne on May 15, 1947, Dr. Reginald Webster, whom we all respect and revere as a master pathologist and master rhetorician, delightfully and aptly said: "... at what disadvantage is the radiologist, restricted to a silhouette, and shackled to a shadow!" The last two phrases have tickled the fancy of medical practitioners, and because they have assumed the proportions of a cliché, when reguoted as here, they may savour of rhetorical slickness, but actually they have a profound and significant meaning. These words express the deeply considered opinion of a wise and sincere leader of medical thought. I replace them in their context. Dr. Webster was discussing healing in pulmonary tuberculosis, and this is what he said:

If, then, the pathologist in his favoured position, with the dissected specimen at his disposal, cannot without resort to the bacteriological methods determine healing in the sense that no viable tubercle bacilli remain, at what disadvantage is the radiologist, restricted to a silhouette and shackled to a shadow!

Dr. Webster may well have made this observation, not only in relation to healing of tuberculosis, but also relative to the primary detection of tuberculosis.

In both of these the great limitation of the radiologist is related to time. When the shadow or shadows of disease are visible we have a basis for suppositions. In those cases in which it is not possible to obtain positive bacteriological findings, serial films taken at intervals of a month or two may with reasonable certainty proclaim the condition to be a tuberculous one, or the progressive, regressive, or static quality of a known lesion may be declared. One may draw an analogy from the mundane incident of watching a vehicle from afar off on a straight stretch of road. This object must be observed in its background for some time before one can determine whether it is moving away or towards one, or whether it is moving at all.

Truly we are shackled to shadows, when we can see the shadows. But it is not always possible to observe the shadows even when a pathological process is present. The radiologist is limited here by his skill and experience as a radiologist, by his whims and fancies in relation to many factors of kilovolts, time, milliamperes, makes of machines, films, screens, and what not; even by the quality of the light he uses for viewing his particular fancies in films: his fancy may be for the blonde type more than for the brunette in which black is the predominant feature, and contrast is his god. He is fettered to the dexterity and technical ability of his radiographers. It has been said that diagnosis by a pathologist is a matter of taste: on the same theme radiologists' tastes may well influence their opinions concerning pathological change seen or not seen on films of the same patient taken in various X-ray departments or even in the same department. Radiologists even give different opinions about the same films after a short interval of time between readings. You all know about the test in the United States of America in which five selected readers (three chest physicians and two radiologists) not only gave opinions that varied amongst themselves, but also gave different personal opinions on the same films when viewed a second time after a two months' interval. The 17-inch by 14-inch films of over 1200 discharged soldiers were used for this test. At two separate sessions two readers' opinions differed in their readings by 41% and 29% respectively.

Apical lesions are particularly difficult to detect, and nodules elsewhere may be hidden by rib shadows. I have seen the same nodule appear and reappear in a series of films, and in tomograms there present themselves most alarming shadow shapes which were never suspected from a series of routine films, including films taken a few minutes before the tomography.

We radiologists are indeed restricted to silhouettes and shackled to shadows when we are not provided with

histories by our colleagues. Many referring doctors are most cooperative in this respect. Others are negligent. This bespeaks an inefficient system wherein one medical man has not access to clinical findings and an intimate knowledge of patients, because the referring physician is too overworked or unwilling to vouchsafe this information to the man from whom he seeks help. The ideal method obtains at the Tuberculosis Bureau in Melbourne where the radiologist reads films in association with clinical tuberculosis officers. Each patient's dossier and films are dovetailed in discussions when the films are presented. The radiologist should be limited only to a good history, a good summary of the clinical findings and the films of his fancy. Thus he would be a consulting coordinating doctor and not confined to the work of a guerilla technical quack.

This limiting of the radiologist to his silhouettes and his shadows is not entirely the fault of referring practitioners, but is primarily due in part to the teaching of medicine in our student and post-graduate clinical schools, where at times a lecture by a medical teacher resolves itself merely into a demonstration on films. When students and graduates have come along to listen to an erudite discussion on the "clinical aspect of diseases" they are shown films. This indictment of such a practice stimulates one to the constructive criticism that it were better for the teacher to show pathological specimens than shadows and silhouettes. The use of films instead of diseased tissue for this purpose is sending a boy on a man's errand, and presents an exalted idea of the value of films which reacts unfavourably on radiologists who in practice are driven to expend much supposition on a straitened income of information. No wonder that the account of the case is sometimes overdrawn.

The dearth of information available in relation to patients with chest conditions may be discussed from the angle of the relative limitations of the histories in thoracic and gastro-intestinal investigations. In the latter we may burrow in the mazes of the psychosomatic, and the unerring findings of the mortuary and operating theatre are at our command. Many of our reports in gastroenterology are based on the psychic backgrounds of the patients, and we have mental pictures of pathological specimens taken from the quick and the dead while we are making screen examinations or viewing films. This Freudian foraging into mental processes to gain a comprehensive survey of the workings of patients' digestive tracts and this Spilsburian sifting of pathological specimens are denied to us in viewing chest films, for delving into the mental condition of patients suspected of pulmonary tuberculosis does not help us, except in respect to irritability, and post-mortem or post-operative specimens of early exudative pulmonary tuberculosis are not often available to radiologists. As a rider to this discussion of pathology I remind you that the radiologist must restrict himself to the pathological terminology which is logically applicable. Such a term as "caseation" lies not within his ambit, for no radiologist can possibly determine this state from mere perusal of X-ray films, no matter how good a history is forthcoming.

Overreading and underreading I have mentioned, and I return to them. The physicists have directed our attention to the fact that radiologists may be limited considerably by varying degrees of ability to resolve shadows, particularly on microfilms, and no intensity of training would counter a physical disability in this field. Critical testing of all readers of microfilms should therefore be undertaken to eliminate those not suited by nature for this work. "Overreading" and "underreading" by experienced radiologists would then not be derogatory terms but would be annotated and respected as are other physical imperfections. And, as an aside, I state that overreading of microfilms is a good thing.

I have tried to be dispassionate in this discussion of some features of the use of X-ray examination. To the ardent medical practitioner most cases are romantic realms of inquiry wherein the scope for flights of imagination are unlimited. He must come down to earth as the pattern resolves itself, and must pinpoint a clinical entity

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or set of pathological states. On the other hand, the radiologist must be restrained by the lack of incident in his investigation of chest conditions. There is something impersonal about the perusal of films, but the resultant opinion, which must be expressed in the written word, is endorsed by his signature. The X-ray report may be the significant picture in the jigsaw of signs, symptoms, and relevant history, but this key is given to the clinician to fit into its proper place. Finally, as a physician practising as a radiologist, I believe the real continuity, the real permanence of the practice of medicine lies not in mechanical inventions, but in history-taking and careful clinical observation, the proper instruments of the true physician possessed by an innate urge to cure and comfort the sick.

TREATMENT OF PULMONARY TUBERCULOSIS.¹

By LINLEY HENZELL,
Perth.

In discussing the treatment of pulmonary tuberculosis, one must first clarify its aims. From the public health aspect, these are to render the infectious patient non-infectious by healing the disease, and if this is not completely possible, to reduce his infectivity by training and educating him in methods to protect others, and by reducing the number of tubercle bacilli he discharges. From the patient's aspect one must add the need to preserve, as far as possible, his respiratory function and to restore his capacity for work, either in his old occupation or in some new occupation if his former one is unsuitable.

Within the past fifty or sixty years there has been a progressive evolution in the methods adopted to achieve these aims. Some of these have been tried and abandoned, others developed and improved in conformity with increasing experience of the results of treatment. In spite of divergence of opinion concerning the value of some methods, continued experience over the years has stabilized the value of others in the opinion of all workers in the disease throughout the world.

Tuberculosis is a disease the course of which is difficult to predict and whose infinite variety of manifestations as it affects the lungs and thoracic contents makes it a fascinating and absorbing study. It is known that many of us have had it without being aware of its existence and that we have successfully overcome it unaided. It is a fact that in all cases diagnosed, the death of about one-half of the subjects is certified as being due to some other cause. It is a chronic infection with a strong tendency to relapse. Many lesions discovered in an early stage will relentlessly progress if untreated, while others will heal spontaneously and be discovered by accident years later. Patients with cavitation, if untreated, have an expectation of life on an average of from three to five years; that is, their prognosis approximates to that of cancer. Evidence of the extent, activity and prognosis in any case depends on the summation of clinical, radiological, bacteriological and hematological studies, often extending over a considerable period of time. If any given case of the disease may or may not proceed to a fatal outcome, it is only with a long experience of many cases with an open mind that the physician can hope to select from any group of patients those for whom certain lines of treatment are necessary.

The evaluation of the effects of treatment is complicated by many other factors which are variable and impossible to assess. Age, sex, racial origin, nutrition, economic status, occupation and intelligence are some of these and, combined with the protean manifestations of the disease itself and the differing standards of treatment pursued in different clinics, they render the establishment of control groups for statistical purposes of almost insuperable difficulty. If, for example, the value of collapse treatment is

questioned because of the fact that no noticeable fall in the mortality rate has been observed in recent years in Australia, it is pertinent to point out that a correct appreciation of the indications for and conduct of collapse treatment has been determined only within the past ten years in Britain, Europe and America, and that it is by no means universal as yet in this country. Workers in tuberculosis are convinced almost without exception of the value of collapse treatment and therefore dare not deny it to certain of their patients for whom it is indicated. Simultaneous control groups are therefore unobtainable. A comparison of mortality in any community in which extensive collapse measures have been instituted within recent years with the mortality of a period before their institution is vitiated by a possible natural biological change in the relationship between the parasite and its host, and by progressive changes in the economic, nutritional and educational standards of the community. Nevertheless, so many of us have during many years observed the beneficial results, often dramatic, of certain lines of treatment, that we continue to urge them on our patients with every confidence in the clinical result, in spite of the lack of a mathematical proof of efficacy.

The growth of thoracic surgery in the past ten years and its application to the treatment of pulmonary tuberculosis, great improvements in radiological technique, new developments in the laboratory investigation of the disease and the progressive evolution of anaesthesia have revolutionized our concept of the management of pulmonary tuberculosis. The modern chest hospital, as fully equipped as the general hospital and staffed by physicians, surgeons, anaesthetists, pathologists, physiotherapists and specially trained nurses, has replaced the sanatorium in the treatment of the patients with the "acute" condition. These hospitals are no longer isolated in the country, but are situated in city areas. The sanatorium is used more for the restoration to normal living conditions of the ambulant patient in the course of his rehabilitation, as the home of the patient with a chronic lesion and as the centre for training for sheltered workshop, settlement or new occupation.

The various medical members of the chest team cannot work in watertight compartments. The physician must understand the control of surgical treatment and might well be also an adept with the bronchoscope and the thoracoscope. The surgeon and radiologist must have a broad clinical experience of tuberculosis, and the physician and surgeon a wide knowledge of the radiology of the chest. The pathologist must have clinical contact with the patients whom he is investigating, and the anaesthetist must be familiar with the clinical aspects of the disease and its complications in order to understand fully his anaesthetic problems. Every member of the team should have a knowledge of the responsibility of all his fellow members. And all should frequently meet in conference to discuss the management of every patient in the hospital so that any decision as to treatment should be the concerted decision of the whole team. It must inevitably follow that all have a wide knowledge of thoracic disease generally, as many subjects of non-tuberculous disease of the chest will pass through their hands. Every patient should be presented for discussion soon after his admission to hospital, so that a future tentative programme of control might be decided upon; every member of the team will be familiar with the progress of all patients and therefore better able to form an opinion in the future concerning their treatment.

This aspect of teamwork must be stressed; it is only by the constant collaboration of the team's members, each bringing his own viewpoint, that a fusion of all aspects of the case can produce a composite picture.

In the short time available it is proposed to deal briefly with the principles governing the various lines of treatment in common use.

Rest in Bed.

Rest implies mental and physical relaxation and needs sympathy and cooperation between doctor and patient. Many people lie in bed for long periods without resting; their minds and bodies may remain tense and their pro-

¹Read at the Plenary Session of the Australasian Medical Congress (British Medical Association), Sixth Session, Perth, August, 1948.

gress is retarded. The hospital or sanatorium regime should encourage and inspire this rest which can be greatly aided by instilling hope for the future by an adequate and early programme of rehabilitation. Rest is not rest when it is interrupted by week-end leave and by misguided efforts to amuse the patient by premature occupational therapy. The harmony of the triad of patient, doctor and nurse is of vital importance in the early weeks in hospital. It may safely be said that real rest is the mainstay of all lines of treatment of pulmonary tuberculosis, that no other treatment will succeed without it, that it will often succeed alone, especially for the minimal lesion, that it is usually not persevered with for a sufficiently long time, and that all patients, except those with far-advanced disease, will be much improved by its judicious use. Complete rest can be obtained only in hospital or sanatorium. There are too many distractions at home, and the patient who insists that the mental ease of being with his family will aid his relaxation almost always deceives himself. For rest to be absolute and sufficiently prolonged, the importance of adequate hospital and sanatorium accommodation and nursing staff is obvious. A well balanced and adequate diet and continuous fresh air are necessary adjuvants.

In adopting any line of treatment it should not be forgotten that no method should be asked to perform the impossible. How often has the patient with cavitation been rested in a sanatorium, improved and discharged to his home, only to return subsequently with disease too far advanced for any treatment to be successful! It is in these cases that the initial choice of rest treatment alone has been ill-advised, and that early induction of an artificial pneumothorax or the decision to perform a primary thoracoplasty might well have averted the subsequent catastrophe. Even minimal disease in many young women often runs an unpredictable course and a failure to respond promptly to rest necessitates an early pneumothorax. It is even more unreasonable to expect the patient with cavitation, or the one with a sputum which persistently yields tubercle bacilli in spite of a fair trial of rest, to get well without more energetic measures.

Experience has shown that graduated exercise is harmful for active disease. It should be reserved for the stage when quiescence has been achieved by rest and other means and is then used as a "hardening-up" process before discharge from hospital or resumption of work.

Collapse Treatment.

It has been argued that, as tuberculosis is a systemic disease, it might be illogical to treat surgically a local manifestation. It is just to reply that, although the infection may be general, there is almost always one part of the body most heavily involved, and that in pulmonary tuberculosis it is usually one lung, and at a sufficiently early stage, one part of one lung. Experience has shown that the general infection is best controlled by controlling the local part most heavily diseased and it has been shown that in bilateral disease healing of the worse lung by surgical means will often result in the healing of the better one.

It has already been said that practically all workers in tuberculosis are convinced of the very great value of collapse treatment. Increasing experience, however, shows that it must be correctly applied and controlled, with a full knowledge of its limitations and shortcomings, and that if applied in the wrong case or at the wrong time it can do more harm than good.

Artificial pneumothorax, the first of these measures to be used, has probably been the most subjected to abuse. To introduce air into the pleural cavity and to continue with refills is a relatively simple procedure. But to induce an artificial pneumothorax prematurely, before bed rest has produced defervescence of exudative disease, or to continue refills without a realization of the risks of undivided adhesions, bronchial disease, atelectasis, the tension cavity and empyema, may well be to invite disaster. No artificial pneumothorax should be induced without an appreciation of these risks or without a realization that it is unfair to expect it to control gross disease; nor

should it be attempted if facilities are not available for its frequent radiological control, the early division of adhesions by internal pneumolysis, the assessment of bronchial disease by bronchoscopy, the control of empyema, and the courage to make an early decision to abandon it if unsuccessful in favour of a more radical measure.

Artificial pneumothorax often produces rapid improvement with disappearance of sputum in a relatively short time; but there is a long road home. Refills of air have to be continued for years. When the time comes to abandon it, the pleura may have become rigid with organized fibrin, which together with a widespread parenchymal fibrosis may greatly hinder reexpansion of the lung, displace the mediastinum and severely limit the lung's functional capacity, which may be further reduced by *endarteritis obliterans*. These late difficulties call for a strict examination of the indications for its induction and a rigid control through its course. They are emphasized lest the misuse of this very valuable and proven treatment should tend to bring it into disrepute.

The temporary use of an artificial pneumothorax may be an advantage, particularly in relatively minimal disease, for it permits of a functioning lung at the termination of treatment. The liability to reactivation of the disease on reexpansion of the lung or the revelation that in some cases the control of the infection is limited to the period of the collapse, makes its temporary duration in some cases a serious handicap to the permanent healing of the disease. This can be minimized by a careful and experienced selection of cases for its use and by the possession of an alternative method which produces a permanent collapse of the diseased area of lung—thoracoplasty.

The realization that the permanent control of disease by an artificial pneumothorax is limited by the nature and extent of certain types of pulmonary tuberculosis, together with improved surgical technique and anaesthesia, local or general, has led within recent years to a greatly increased use of thoracoplasty, combined with apicolysis, and carried out in stages. The selection of the right type of case and the right time to operate, the elimination of operative complications by carefully devised and rigidly enforced pre-operative and post-operative treatment, the preservation of respiratory function and shoulder girdle movements and the minimizing of deformity by the physiotherapist, the staging of the operation and the reduction of anaesthetic hazard, have reduced the general operative risk to such a degree that the operation can now be confidently recommended and accepted by the patient with comparative complacency. The drawbacks of operative shock and risk, poor respiratory and muscular function and deformity no longer apply when it is considered that the operation produces very satisfactory results in 80% of suitable subjects who would otherwise be condemned to a relatively early death, or at best to life-long invalidity.

Phrenic nerve interruption, temporary or permanent, is not used to the extent that it was formerly, nor is pneumoperitoneum. Both are of value in some cases of artificial pneumothorax, but the proper understanding of the indications for collapse therapy renders the use of these procedures less frequent.

Within recent years, the development of controlled anaesthesia has enabled the surgeon to open the pleural cavity with confidence. The excision of one or more or all lobes of a lung can and does save life in cases of acute and extensive localized disease that would be most unlikely to respond to any other form of treatment. The selection of such cases calls for the experience of the whole team. The operative risk is still not light, but the routine pre-operative and post-operative use of streptomycin does much to control bronchial disease and prevent spread in the same or to the other lung. It is found to be quite practicable to cut across a bronchus the tuberculous condition of which has been healed and controlled by streptomycin. Post-operative care must be constant and in the hands of a highly trained surgical and nursing team. Much will depend on the courage, confidence and skill of the surgeon and on the post-operative control of the patient. Frequent radiological observation of the position of the mediastinum, the presence of fluid in the pleural

cavity, with often-repeated aspiration if indicated, and control of the intrapleural pressures are necessary. The closest cooperation between surgeon and physician is needed.

The nursing of the subjects of these major surgical procedures is of prime importance. A special nursing team should be trained and regarded as an integral and essential part of the composite treatment. Just as a long acquaintance between patient and doctors in the period of hospital and sanatorium treatment before operation establishes a feeling of mutual confidence, so also does a continuity of contact between patient and nurses in the pre-operative and post-operative treatment. The success of these operative measures largely depends on the post-operative care of the patient.

The early promise of streptomycin has not been fulfilled in the average case of pulmonary tuberculosis. However, its ability to heal disease of the larynx and bronchus, combined with its power to control recent extension of the infection to previously healthy lung, makes it a very valuable accessory in major surgical procedures. It also offers some hope in acute miliary tuberculosis. Although it is, as yet, premature to speak of its permanent place in therapeutics, it has opened wide the possibility of discovering some other antibiotic which will revolutionize the treatment of the disease.

Mention must be made of tuberculin. Its discovery by Robert Koch over fifty years ago, and the early demonstration that it could produce profound reactions in the tuberculous, offered hope that it might be a valuable agent in treatment. One statement may be made with certainty and that is that if used indiscreetly it will make the patient worse. The consensus of opinion of the great majority of observers is that the claim that it can be used with beneficial results has not been established. Nevertheless, its use is continued in certain cases by a few experienced and capable physicians who express confidence in its value.

The salts of certain heavy metals, especially gold, and to a lesser extent cadmium, have had their vogue. Apart from their toxic potentialities no convincing results have ever been put forward to show that they are of value and almost all physicians who have had the most experience of them have now abandoned their use.

Other surgical procedures for the closing of tuberculous cavities are in use. Some tension cavities in which there is bronchial disease will not close with artificial pneumothorax or thoracoplasty. The method of suction drainage of Monaldi will often reduce their size and contents to such an extent that a subsequent thoracoplasty will be successful. The general opinion is that, as a sole measure, this drainage has little hope of success except in a few cases as once it is discontinued the cavity will reexpand and open again.

Cavernostomy, or the external surgical drainage of a persistent cavity, can be used with success in a small number of cases.

Conclusions.

From what has been said it will be seen that certain conclusions must inevitably be drawn. Rest, often prolonged, has an enhanced reputation in the treatment of almost all stages of the disease, either as a sole measure or combined with others. Artificial pneumothorax is firmly entrenched, but only with proper selection of cases and facilities for its adequate control, the division of adhesions and the treatment of complications. Thoracoplasty is being used in a greater number of cases and with increasing success. Excision is practised in a larger number of cases every year. Streptomycin has proved its value, especially as an adjunct to surgery. Graduated exercise has been exorcized from the treatment of active disease. The use of gold has been practically discontinued and tuberculin is used by only a few.

The facts that for a large number of patients coming under observation at a late stage of the disease no line of treatment offers much prospect of permanent improvement, that surgical methods are used so largely in the treatment of an infectious disease, that the search for an

antibiotic has met with only partial success in streptomycin, must act as a chastening reflection for all thoughtful observers. Even when the search for an efficient antibiotic proves more successful, surgery will doubtless be necessary for cavitation and to correct the mechanical effects of the disease on the lung. Our aim must be to detect all cases at an earlier stage to make the lesions more amenable to healing. Other speakers will deal with this aspect; one can only add in conclusion that the treatment of the diagnosed infection is only one link in the complete chain of tuberculosis control.

SINUSITIS IN CHILDREN.¹

By SAMUEL PEARLMAN,

Honorary Surgeon, Ear, Nose and Throat Department,
Adelaide Children's Hospital.

In this paper I am principally concerned with inflammatory disease as it affects the maxillary sinuses or antra. Other nasal accessory sinuses are sometimes involved, especially the ethmoids, but the antra are almost invariably involved in chronic disease and demand our primary attention.

ANATOMY AND PHYSIOLOGY.

The maxillary sinus is the only member of the accessory nasal sinuses which is present at birth. It appears as a slit-like evagination from the ethmoid infundibulum. Pneumatization proceeds rapidly. Whereas at birth the floor of the sinus lies four millimetres above that of the nose, at eight years of age it is level with it, and at fifteen years it lies four millimetres below it. Development is determined by dentition, and it is noteworthy that the deep alveolar groove is absent in younger children. The sinus mucosa is covered by a pseudo-stratified ciliated columnar epithelium continuous with that of the respiratory tract. The stroma is very thin and loose and contains numerous goblet cells, but very few glands. In the nasal cavity itself the mucosa is characterized by numerous glands and cavernous spaces, particularly in the inferior turbinate region.

No concept of sinusitis can be complete without a due recognition of nasal physiology. Investigations in recent years, particularly those carried out by Fabricant, Proetz, Hildig and others in America, have been of considerable importance. Mention must be made of the nasal secretions, of ciliary activity and of nasal respiration.

Firstly, in regard to the nasal secretions: mucus is continuously secreted in the goblet cells and mucous glands which receive their innervation from the autonomic nervous system. The mucous film so formed has been shown to consist of two layers, an outer viscous layer which makes contact with the tips of the cilia, and a deeper watery layer in which the cilia beat. Normal mucus has a pH of 5.5 to 7.4 according to various investigators. It has well marked germicidal properties, depending on its lysozyme content and its acid nature.

Secondly, the role of the cilia in nasal physiology is now better understood. Human nasal cilia beat at a rate of three to twelve times per second, always in the same direction. They beat vigorously in an alkaline solution of pH 8.5 and slow down in a medium of pH 5.5 or less. The direction of beat is unchanged in the presence of artificial ostia, and they tend to move the mucous coat in a continuous stream towards the natural ostium. In the nasal cavity, the nasal secretion and debris are speedily propelled towards the naso-pharynx. The extraordinarily powerful action of the cilia enables them to remove heavy secretions with amazing facility, even in the presence of infection. Following trauma and infections, regeneration of the cilia takes place rapidly and this may occur after complete removal of the mucosa.

¹ Read at a combined meeting of the Section of Oto-rhino-laryngology and the Section of Pediatrics, Australasian Medical Congress (British Medical Association), Sixth Session, Perth, August, 1948.

Thirdly, reference might well be made to nasal respiration, which is important in maintaining ciliary functions. In inspiration the air current passes upwards and backwards over the middle turbinate, tending to develop a negative pressure in the sinuses, and producing, as it were, a siphonage action through the natural ostium, replacing stagnant air and removing secretions if not too tenacious. The conformation of the *hiatus semilunaris* and infundibulum is the essential factor in the production of this negative pressure. The deep, narrow infundibulum acts like a suction tube placed at the maxillary ostium, and the *hiatus semilunaris* has a valve-like action preventing the return of the secretion to the sinus.

NASAL PATHOLOGY.

The sinuses are normally sterile, and even in the nasal cavities pathogenic organisms such as pneumococci and streptococci are rarely present. *Staphylococcus albus* and diphtheroid bacilli usually occur, with *Staphylococcus aureus* and *Micrococcus catarrhalis* less frequently. When streptococci, pneumococci, or *Hemophilus influenzae* are found, infection of the sinuses or nasal cavities may be predicated, and one or all of these organisms can almost invariably be found in the presence of acute or chronic sinusitis. Pneumococci appear to be more prevalent in the acute type, and streptococci or mixed infections in the chronic type of disease.

Acute nasal infections produce stasis of the mucociliary stream, with physico-chemical changes in the mucus, allowing bacterial penetration of the mucosa. The sinuses are infected by contiguity or by infected secretion forced into them. Swelling around the ostia interferes with drainage and ventilation of the sinuses. As a consequence the mucosa becomes hyperæmic, and exudation takes place of serum, fibrin and polymorphonuclear leucocytes, and later of lymphocytes, plasma cells and cast-off columnar cells. The thin mucosa becomes swollen and secretion may be copious, but healing occurs rapidly as the infection is overcome. In chronic inflammation, the chief change is proliferation of inflammatory cells, mainly in the stroma, resulting in the formation of granulation tissue. Thus the mucosa becomes thickened and sometimes polypoid. Healing takes place by fibrosis, the epithelium remaining more or less intact. In prolonged and severe inflammations the epithelium may undergo metaplasia to a more resistant stratified squamous type. This may be accompanied by either atrophy or cystic dilatation of the glands and an underlying osteitis.

SYMPTOMS, SIGNS AND DIAGNOSIS.

Milder degrees of sinusitis are very common, and are almost invariably coincidental with a prolonged acute nasal infection, depending on such factors as the virulence of the organism, the resistance of the patient, the impairment of nasal ventilation and drainage due to nasal deformities and congestion, the coexistence of allergy, and the use of nasal drops that are harmful to normal mucociliary activity. When conditions are favourable, the sinus infection rapidly subsides; when they are not, a chronic sinusitis supervenes. This is recognized clinically by a history of lengthy head colds following each other with a diminishing interval until they appear to be continuous; by nasal obstruction due to intranasal congestion and stagnant secretions; by nocturnal coughing due to laryngeal irritation or to an associated bronchitis; and by the less common symptoms of mental hebetude, anorexia and earache or deafness. Examination reveals a congested nasal mucosa, mucopus along the nasal floor or issuing from under the middle turbinate, and a mucoid coating over the posterior pharyngeal wall. Lymphoid tissue in the lateral pharyngeal walls is often prominent and there may be enlargement of some cervical glands. Radiological examinations reveal a loss of translucency in the sinuses and evidence of mucosal thickening or retained secretions. These radiological investigations are routinely carried out and seem fundamentally necessary for diagnosis; but, paradoxically, they are most misleading unless carefully measured against the clinical findings. They do not *per se* accurately diagnose chronic inflammatory sinusitis in children.

Diagnosis of manifest sinusitis can be fairly accurately established from the above clinical picture. In certain cases of latent disease, or when doubt exists, the diagnosis can be clinched by the exploratory suction technique of Watson-Williams. Secretions can be withdrawn from the sinus after puncture and the injection of two millilitres of sterile normal saline solution, and its macroscopic and microscopic nature noted. Positive evidence of infection by culture is, of course, conclusive.

SINUSITIS AND ASSOCIATED DISEASES.

Infected Tonsils and Adenoids.

Most patients with established sinusitis coming to the rhinologist have already had their tonsils and adenoids removed. There is no doubt that removal of adenoids has a beneficial effect on sinusitis in the early stages by allowing greater freedom for nasal ventilation and by disposing of an infected lymphoid mass which tends to keep the sinusitis "alive", either by a direct or by a sub-epithelial bacterial spread. In this regard, however, the tonsils seem to play very little part, and they should not be sacrificed in children, at least certainly not under the age of five, except on very strong indications. It is probable that they may subserve some purpose in the development of immunity, and moreover the operative risk appears to be greater in the younger children. Adenoids should be carefully removed, and when symptoms persist in spite of this, sinusitis should be suspected; repeated colds *et cetera* should not be treated by drugs or further adenoidectomy without reference to a rhinologist. Various investigators have found that as many as 20% of their patients have pus in one or both antra when being operated on as a routine measure for the removal of tonsils and adenoids.

Respiratory Infections.

Experiments with dyes injected into the nasal sinuses have shown that they eventually reach the lungs, mainly by the direct tracheal route. Lymph follicles in the bronchial walls and mediastinal lymph glands become enlarged and infected when chronic sinusitis is present, and this is one of the more serious aspects of the disease in children. X-ray examination of the lungs shows increased prominence of the trunk shadows extending out from the hilus, especially towards the base, and a general thickening of the root of the lung. Nocturnal cough proves troublesome to the patient and a worry to the parent, and more serious lung involvement can occur if the sinuses remain untreated. Minor pulmonary episodes seem to be common in children with chronic sinusitis.

Bronchiectasis.

Bronchiectasis is associated with purulent sinusitis in over 50% of cases. It is unknown whether the sinusitis is a primary or secondary condition, although the consensus of opinion seems to incline towards the view that it arises secondarily to the bronchiectasis, that treatment directed towards the sinuses has little influence on the progress of the lung condition, and that occasionally sinusitis resolves after surgical removal of the diseased lung tissue. One theory is that there exists a congenital weakness of tissue or lack of tissue resistance affecting both the sinus and bronchial mucosa, and that infection may take place primarily in either. In the early stages at least, and probably in the later stages, surgical attention to the sinuses seems justifiable as an adjunct to medical and surgical control of the bronchiectasis, helping to arrest the progress of irreversible changes.

Allergy.

Every child with nasal symptoms is a possible sufferer from allergy and investigations should be carried out to eliminate this possibility. This involves the taking of a careful personal and family history. In nasal allergy the nasal discharge is watery or mucoid, obstruction is bilateral and pronounced, sneezing is common and the mucosa is occasionally pale and boggy. Eosinophile cells may greatly outnumber the neutrophile cells in smears, and sensitivity tests will sometimes help to indicate the offending allergens. However, it is the belief of most rhinologists that infective sinusitis and nasal allergy

often coexist, and that the nasal changes produced by the allergy tend to make conditions suitable for the incidence of infection. Also, rhinologists speak of bacterial sensitization, and a child presenting signs of mixed allergic and infective rhinitis will often recover completely when adequate treatment is directed to his sinuses.

Ear Infections.

Ear infections are often associated with sinus disease. Lymphoid tissue at the pharyngeal orifice of the Eustachian tube is constantly infected by nasal discharges with resultant tubal catarrh, *otitis media* or mastoiditis. Some otologists place this association as high as 90%; in my experience, it is not nearly so common.

PROGNOSIS AND TREATMENT.

It is undoubtedly true that in the majority of cases acute, subacute and chronic sinusitis undergoes resolution with or without treatment. This is a tribute to the able defence mechanism of the nose and to the increased resistance with the growth of the child. However, if untreated, many will remain chronic sufferers, and as time goes on the primary condition—the sinusitis—will be overshadowed by secondary developments such as bronchitis and *otitis media*. Many cases of gross sinus disease in adults are found to have had their origin in early childhood. Many cases of chronic pulmonary sepsis are due to neglected sinusitis commencing in childhood.

Non-Surgical Treatment.

In the planning of treatment a good sense of judgement is necessary. Except in the presence of obviously gross disease or serious complications, conservative treatment should be tried. The following methods are adopted.

General Measures.

General measures to increase the resistance of the patient are important. According to Hettler all these children suffer from a lack of protective foods, especially vitamins B and C, minerals and proteins. Particularly is more vitamin C needed as in chronic infections there is a deficiency of this vitamin. Regular meals, sufficient rest and relaxation are essential. Iron is necessary to combat anaemia when present. Home conditions should be studied. A child spends almost one-half of his existence in a bedroom, and this will often be found to be cold, damp, ill-ventilated and crowded. The child's parents may suffer from chronic nasal discharges and become a source of constant reinfection.

Nasal Drops.

Nasal drops have a useful place in treatment, their usefulness depending on two factors: (i) that they do not interfere with the physiology of the nose; (ii) that they are instilled with the patient's head in the optimum position.

Vasoconstrictors used in the nose should, according to Fabricant, restore and maintain normal ciliary activity, and they should have preferably a slightly acid pH value between 5.5 and 6.5. Ephedrine 0.5% to 1% in normal saline solution meets these requirements; all other nasal drops commonly used, such as silver preparations, mercuriochrome, oily drops and sprays, are harmful in varying degrees and should not be used. The drops should be instilled with the patient in the lateral head low position as described by Parkinson. The ephedrine is prescribed in 1.8% saline solution and is diluted with warm sterile water before use to avoid the adverse chilling effect on ciliary activity. A whole dropperful is instilled in each side, the lateral head low position being maintained for three or four minutes. Thus the fluid reaches the *hiatus semilunaris*, relieving congestion around the ostia and facilitating ventilation and drainage.

Displacement Treatment.

Displacement treatment was described by Proetz. The child's head is placed over the end of the table with the chin and external auditory meatus in the same vertical plane. Ephedrine-saline solution is dropped in one nostril, to fill the naso-pharynx. Intermittent suction with a

pressure not exceeding 180 millimetres of mercury is exerted on one nostril whilst the other is kept closed, the child shutting off the naso-pharynx by repeatedly saying "K", "K". A negative pressure is produced in the sinuses and the solution enters these cavities. This procedure can be repeated every second or third day. Penicillin solutions can be thus used, which in strengths under 5000 units per millilitre are thought to have no deleterious effect on ciliary activity. If care is taken in the handling of children, their cooperation is usually forthcoming.

I have recently analysed the results of this displacement therapy in 25 patients treated by me in private practice during a three-year period, 1945-1947. All of these children, except four, had had their tonsils and adenoids removed at least twelve months prior to treatment. Six of them had a mixed allergic and infective condition; the remaining 19 I considered to have a purely infective condition. Six also suffered from deafness. Only four of the patients remained unimproved after adequate displacement treatment. Nine I listed as obtaining complete cures. The remaining 12 were definitely improved, and two of the six with allergy were also improved. These figures, I believe, bear out the claims of success of other rhinologists who use the Proetz displacement treatment.

Irradiation of the Naso-Pharynx.

The lymphoid tissue in the naso-pharynx cannot always be completely removed by operation, and it tends to regenerate especially in the presence of nasal infection. This lymphoid tissue is very sensitive to radium emanations, and two or three doses at monthly intervals of 2000 millicuries is sufficient to destroy it. The radium is used in the form of radon in specially devised nasal applicators. An attempt should be made to clear the naso-pharynx of all lymphoid tissue when chronic sinusitis is present.

Short Wave Therapy.

Short wave therapy has been used considerably at the Adelaide Children's Hospital for some years. It is my opinion that in mild chronic cases it may hasten recovery; if it does not do so within six weeks it is not worth persisting in, and recourse must be had to other measures.

Surgical Treatment.

Antral Puncture.

The simplest surgical procedure is antral puncture, with washout with normal saline solution and instillation of three millilitres of penicillin solution (5000 units per millilitre). When tonsils or adenoids are being removed and antral disease is suspected, this procedure should be carried out for its diagnostic and therapeutic value. Retained antral secretions appear to be a suitable nidus for bacterial growth, and when these are washed out conditions become more favourable for restoration of a healthy mucosa. Even one washout will often prevent chronicity.

The Intranasal Antrostomy Operation.

The intranasal antrostomy operation has three objects: (i) to initiate and maintain drainage; (ii) to provide ventilation; (iii) to remove grossly diseased tissue when possible.

The operation was devised when our knowledge of nasal physiology was limited. After the ordinary intranasal antrostomy in children one is struck by the frequency with which secretion lies along the nasal floor under the inferior turbinate, and also blocking the artificial ostium. The dependent drainage theory breaks down, partly because of the thick mucinous nature of the secretion, but mainly because the antral cilia and the inspiratory air current are placed at a disadvantage. The new antral "window" cuts across the muco-ciliary stream, and the siphonage action previously alluded to is modified. This operation, therefore, fails to restore normal physiology. Furthermore, after intranasal antrostomy in children, we find after-treatment difficult, irrigation and even suction becoming increasingly trying both to the staff and the patients, eventually upsetting the nervous balance of the children.

In 1944 I "experimentally" operated on six children by the radical approach leaving the naso-antral wall completely intact. They all had diseased mucosa which was removed where it was grossly thickened. A specially devised metal tube was inserted in the antrum and sutured to the mucosa of the gum and cheek. Irrigations were carried out daily through this for a week. It was left to the intact and regenerated mucosa to deal with residual infection. The immediate results were good and when the patients were last examined these were maintained. One infection, however, appears to have recurred after three years and will need further attention.

After antibiotics became available, I decided to insert a small-calibre rubber drainage tube through the naso-antral wall below the inferior turbinate. This entails making a small opening with a harpoon and the tube can be inserted easily, a fine, long probe being used as a stylet. The tube is kept in place with a silk suture through the septal tissue beyond the columella and below the septal cartilage. The free end of the rubber tube is attached to the skin over the zygomatic arch with adhesive tape. In the carrying out of the after-treatment the antra are irrigated once daily with either normal saline solution or "Monacrin" 1-5000 solution in 0.45% saline solution, and three to four millilitres of penicillin solution (500 units per millilitre) are instilled into the antra twice daily. The tubes are left in for eight to fourteen days.

When conservative measures have failed in chronic sinusitis in children this is the procedure I now use. During the past four years, in my department at the Adelaide Children's Hospital, numerous children have been thus treated with uniformly pleasing results. The procedure has the following advantages: (i) it is easily carried out; (ii) it is in conformity with our modern views on nasal physiology; (iii) it permits of frequent irrigation with good cooperation of the patient; (iv) it allows antibiotics to be conveniently used over a long period with more or less continuous contact with the antral mucosa; (v) it gives nasal comfort for the patient during after-treatment by permitting nasal breathing; (vi) it does not damage the sensory nerves to the gums and teeth; (vii) it obviates future antral reinfection through a large antral window; (viii) in many cases it gives a permanent small accessory ostium under the inferior turbinate with well healed margins.

Radical Antrostomy.

Radical antrostomy, or the Caldwell-Luc operation, is reserved for cases of gross disease only. It is the only means of direct examination and complete removal of diseased tissue. It is safe if performed with skill in avoiding teeth and the infraorbital nerve. I make only a small naso-antral ostium and insert a rubber tube and carry out after-treatment as described above. When mucosal tissue has been removed, penicillin should be given parenterally and a sulphonamide should be prescribed.

X-RAY INTERPRETATION OF PULMONARY TUBERCULOSIS IN CHILDHOOD.

By COLIN MACDONALD,
Melbourne.

DIAGNOSTIC RADIOLOGY makes no claim to establish, by its unaided efforts, the presence or absence of pulmonary tuberculosis in all children suspected of this condition. Radiology works in the closest concert with the tuberculin skin tests and with bacteriology, and such a trinity of investigation, when linked with the clinical aspects, allows few cases to escape the diagnostic net; this is fortunate, for physical examination alone, especially in the diagnosis of primary tuberculosis, possesses a tradition-

ally poor reputation. But the diagnosis of childhood infection by X-ray films alone would be just as unreliable, and exemplifying how heavily radiology must lean on the other investigational methods is the fact that, of all children who react to the Mantoux test, only a small percentage show convincing X-ray evidence of pulmonary infection—particularly so when the search is confined to a single postero-anterior or antero-posterior film. While it is foolhardy for the radiologist to attempt interpretation without invoking the aid of the Mantoux test, it would appear equally imprudent for the physician, armed with the knowledge of a positive response to the skin test, to explain, in terms of microscopic or macroscopic pathology, the multiform appearances on the films, if he is not completely informed of the radiological technique and other factors which have entered into their production.

The morphology and dynamics of the tuberculous process in children being different from those in the adult, the X-ray aspects are likewise dissimilar. When I commenced radiological practice in Britain twenty-five years ago, the classic work of Anton Ghon had not yet received universal recognition; there were still many who clung to the theory of a centrifugal spread into the lung field from glandular involvement, and this concept of outward perihilar spread did much to delay sound radiological interpretation; but nowadays the names of Parrot, Ranke and Ghon are rightly hallowed, and the primary complex is the paediatric radiologist's *principium*.

Let us briefly consider the X-ray evidence of this primary complex—namely, the primary focus and its perifocal exudate, the lymphangitis, the adenomegaly and the pleural exudate. The complex is diversified in radiographic appearance, for, as Burnet has recently written, what happens in the lung, as well as in other parts of the body, at the time of the primary infection and subsequently, appears to result mainly from genetic constitution or predestined inheritance; so there is nothing pathognomonic about the X-ray appearance of the primary complex. The radiographic demonstration of the primary focus is dependent both on the size of this focus and on the associated perifocal reaction. It has long been known that small primary foci, with little perifocal reaction, elude any detection on the film, and there may be no sign of even larger ones until their size and position are evident by subsequent calcification. Though the site of the primary focus may be in any portion of either lung, I have seen it more frequently in the lower lobes, generally the right; site is one of the outstanding differences between the primary infection of childhood and the deposit of later life, which is in the upper lobe in more than 90% of cases. Multiple primary foci in one or more lobes do occur, though rarely.

The lymphangitis, or, more correctly, the perilymphatic infiltration, of the primary complex may be evident as a localized increase in the linear markings leading from the primary focus to the enlarged hilar glands; but lymphangitis does not reveal itself radiographically unless the primary focus and the adenomegaly are large enough for unequivocal demonstration. There are so many causes of an apparent increase in these markings, that by itself it is of little diagnostic significance. Generally, in all chest radiology, deductions from increased linear markings must be made with circumspection. Particularly when fortified with a positive Mantoux reaction, one can be tempted to assign to increased linear markings a pathological importance which they do not possess.

Radiographic evidence of pleurisy (evidenced by thickening along the interlobar fissures) is common in primary tuberculosis; indeed, it may be the only evidence presented, and then only in lateral views. Effusion occurs as either a primary or a post-primary development, but in my experience it is uncommon under the age of two years. Sometimes the effusion is minimal and is detected only radiologically.

Though pulmonary tuberculosis is one of the commonest causes of thoracic adenomegaly, it is well known that at autopsy pronounced enlargement and even caseation of hilar and mediastinal glands may be found, without their

¹ Read at a combined meeting of the Section of Public Health, Tuberculosis and Tropical Medicine, and the Section of Radiology and Radiotherapy, Australasian Medical Congress (British Medical Association), Sixth Session, Perth, August, 1948.

having been demonstrated radiographically; particularly is this true when only antero-posterior or postero-anterior films are made; lateral and oblique films can be more informative, but these are not always easy to interpret convincingly. Therefore it must be stated that the diagnosis of tuberculous adenitis from X-ray films cannot be made with such facility and frequency as the literature would suggest. The gland shadows are incorporated in the cardio-vascular and hilar shadows, and unless the glands are greatly enlarged or calcified, no radiographic clue to their presence will be afforded on the antero-posterior view. Their enlargement may increase the size of the hilar and cardio-vascular shadows; but because these exhibit such a wide non-pathological variation in size and outline, it is sometimes extremely difficult to be certain that adenomegaly is present. Non-recognition of this wide normal variation leads to a wrong diagnosis of adenomegaly. Pronounced adenomegaly can often give unequivocal evidence of its presence; it is the lesser enlargements which are so often in doubt, and which demand such careful and complete radiographic technique. When the primary focus is large, the glandular enlargement is usually unequivocal; it is when the primary focus is small or not evident, and the glands are not noticeably enlarged or calcified (though still capable of producing symptoms and acting as dangerous foci of haematogenous dissemination) that difficulty is presented. Amongst the factors influencing the non-pathological size of the hilar and cardio-vascular shadows, which must always be remembered in the interpretation of children's chest films, are the following: (i) the respiratory phase in which the film was exposed; the shadows are much wider in expiration than in inspiration; (ii) the degree of postural symmetry—that is, the rotation of the chest; a slight degree of postural asymmetry may make a hilar shadow appear wider than it actually is; (iii) the film-target distance; the shorter the film-target distance, the broader the shadows. However, one group of thoracic glands does lie in a favoured position radiographically—namely, the tracheo-bronchial group, which tend to become enlarged even when they do not directly drain the primary focus, and they, protruding to the right above the hilar shadow, are thrown into contrast with the adjacent air-containing lung. This consideration does not hold good with the true hilar glands, as they are intimately mixed with other constituents of the hilum. Hence, glands definitely discernible as such are rarely seen in the hilar shadows. The bifurcation gland is caseous more often than even the tracheo-bronchial gland; yet, owing to its position within the cardio-vascular shadow, it is not seen in the standard antero-posterior or postero-anterior view, however large and caseating, unless massively and densely calcified. But the lateral and oblique views come to our aid in this situation, and that is one reason of many why X-ray examination of the chest is quite incomplete with only postero-anterior or antero-posterior views.

This question of children's hilar shadows justifies some further comment, as they have been in the past the source of much perplexity and confused interpretation. I agree wholeheartedly with Caffey that it is impossible to define the exact limits of the size and shape of the hilar shadows of all ages; the line of demarcation between the normal and abnormally enlarged is far from sharp. Thus, the diagnosis of slight tuberculous enlargements is always uncertain. Marsh and Washburn have shown that the differences in size of the hilar shadows and broncho-vascular markings in individual children are normal anatomical variants, similar to the difference in colour and shape of the nose in different individuals, and what is normal or optimal for one child is not necessarily the same for another child. And yet, with all the limits of the Röntgen method, it may be fairly claimed it is more satisfactory than the clinical. The physical signs of D'Espine and Eustace-Smith have apparently been thrown into the clinical discard, for the auditory discrimination demanded by these good gentlemen is too exquisite to be expected of the ordinary mortal; well do I regretfully remember the long periods of palpatory and stethoscopic travail spent on these uncertainties when I was in

general practice. At this point, let me suggest that X-ray interpretation is as strongly a personal intellectual exercise as any clinical examination and the deductions therefrom. Frequently seen in case histories is the record that "X-ray examination showed nothing abnormal"; but in such a statement there is an ellipsis. The record more correctly should read as follows: "Dr. A. examined the films and in his opinion nothing abnormal was shown". His colleague, Dr. B., with equal intellectual honesty, might hold a very different opinion.

Though calcification, either in the lung parenchyma or in the hilar glands, may be due to causes other than tuberculosis—for example, histoplasmosis, aspergillosis and coccidioidomycosis—in Melbourne I have almost invariably assumed it to represent infection with Koch's bacillus; we are therefore waiting on a comprehensive testing for histoplasmosis infection. Even when the response to the Mantoux test is negative, tuberculosis is not eliminated, because it is known that the Mantoux reaction may disappear over the years. One must be certain that an opacity in question is actually calcification, for this is frequently simulated by blood vessels seen "end on". These small shadows of vascular origin are of homogeneous density, circular or oval, with clear-cut margins; calcified infiltrations or lymph nodes, on the other hand, are most frequently uneven in density and also in outline; furthermore, calcifications may be simulated by lipiodol residue or by a variety of artefacts, such as spots of developer on the fluorescent screens. Opacities are vascular if they are not constantly present in the area in question in the additional oblique and lateral views; on the other hand, calcifications frequently elude detection when they overlie the rib shadows (particularly in the axillary region), and almost always if they are included in the area of the postero-anterior cardio-vascular silhouette; but in this last case they are easily demonstrated in the lateral view. Calcification, which usually takes a year or more to develop, is reversible; it may become less over the years, and cases have been reported in which it has disappeared. On prognostic grounds it would appear that a careful X-ray search for these calcifications is warranted; a pre-war survey in the United States revealed clinical tuberculosis five times as often in adolescents who as children had had demonstrable calcified areas in the lung fields or lymph glands, as in those infected (as shown by a positive tuberculin reaction) but not revealing any evidence of a previous primary complex in the X-ray film. This finding is in agreement with my own experience of osseous tuberculosis at the Children's Hospital Orthopaedic Section at Frankston, Victoria. In many of the chests of children with osseous tuberculosis, a calcified pulmonary focus can be identified after careful X-ray search. In other words, when a well-proven calcified focus is seen in a child's chest, there is no great cause for jubilation.

There is little that is radiographically characteristic of the various tuberculous pulmonary consolidations. Their appearances can be simulated by all the other types of radio-opacity—inflammatory, neoplastic or obstructive. Probably as valuable an aid as any in differentiation of inflammations is the taking of serial films at fortnightly intervals, because tuberculous shadows are not usually evanescent; if a shadow does not persist for longer than a fortnight, the likelihood of its being tuberculous is remote. Cavitation in a child's lung always arouses suspicion of caseous pneumonia, and if this is present there is usually evidence of infiltration in the other lung; but one must be certain that cavitation is actually present, for it can be easily simulated by a circumferential pattern of infiltration, or even by blood vessels; on the other hand, a cavity may be obscured by overlying and surrounding infiltration. Films of varying radiographic densities, lateral views and tomography are of help in this regard. If the parenchymatous consolidation is associated with pronounced adenomegaly, tuberculosis is likely; non-tuberculous bronchopneumonia may be associated with demonstrable adenomegaly, but this is usually not pronounced or of long duration. The younger the child who gives a positive Mantoux response, the more chance is

there that its pulmonary consolidation is tuberculous. But all too frequently the diagnosis must wait on a positive finding on gastric culture, or on an autopsy.

Abnormal mediastinal broadening may, of course, be due to many causes other than tuberculous adenomegaly. One of these is enlarged thymus; this usually shows a well-defined, almost straight, or only slightly convex lateral border, and often an approximately horizontal lower margin; the lateral view presents a homogeneous opacity in the upper part of the anterior mediastinum lying subternally. Identification is not difficult when it is remembered that the topography of the thymus is different from that of the mediastinal glands; the much-maligned thymus for too long was a whipping-boy of paediatrics, and had taken dreadful punishment over the years since X rays were born. It is now realized that thymic enlargement is less frequent than was previously held (mainly owing to erroneous X-ray interpretation), and even when unequivocally present, it may be innocuous, and not primarily responsible for those many respiratory, digestive and convulsive manifestations for which it has been blamed.

Hilar adenomegaly in infants without a demonstrable parenchymal lesion is most apt to be tuberculous in origin, particularly when the Mantoux response is positive. In older children, such conditions as Hodgkin's disease and leucæmia enter into the differential interpretation and are diagnosed on other grounds. Lateral views are helpful in differentiating mediastinal tumour. Sometimes a clue to neoplasm is given by erosion or widening of adjacent ribs, or even of intervertebral foramina.

Expiratory emphysema and pulmonary collapse, due to partial or complete bronchial obstruction, may of course be caused by other than extramural adenomegaly or intramural tuberculous thickened mucosa; more common causes are foreign body, often non-opaque, and thickened non-tuberculous secretions; when the obstruction is of tuberculous origin, the enlarged glands, perhaps with a primary focus, may be demonstrated, but the diagnosis may have to be made on the bronchoscopic findings or on a positive result on gastric culture. Incidentally, for the demonstration of expiratory emphysema due to a ball-valve type of obstruction, carefully centred films must be made during both inspiration and expiration.

The chest appearance of hæmatogenous miliary tuberculosis is often described as being characteristic; but it can be simulated by other conditions, and the diagnosis made the more difficult by the possible disappearance of the Mantoux reaction. Miliary tuberculosis may be present in the lungs, and yet elude radiographic detection in its early stage; only when the deposits have attained a certain size are they evident on the film. Miliary pulmonary tuberculosis not being an invariable accompaniment of tuberculous meningitis, or meningitis of miliary spread, the chest film may fail to show miliary deposits when the presence of tuberculous meningitis has been established beyond pathological doubt. It is of interest that the percentage of these negative X-ray findings is highest among older children. In true and well developed miliary tuberculosis, the picture is one of fine boiled sago having been thrown from the apices to the bases into the lung fields, which may have lost their linear markings. Later, individual foci fuse and a patchy pattern is formed. The hilar shadows generally are enlarged (but not always), and there is usually evidence of a primary focus, perhaps with calcification. Resolution of the miliary deposits by streptomycin treatment has been seen. The following two conditions have caused me difficulty in interpretation: (i) a "miliary" type of tuberculous bronchopneumonia—a bronchogenic spread from a caseating primary focus producing multiple small lesions through both lungs; these lesions are generally larger than those of true miliary tuberculosis due to hæmatogenous sowing; (ii) "miliary" non-tuberculous bronchopneumonia or bronchiolitis, probably following whooping-cough, measles or influenza; in this bilateral widely distributed process the infiltrations are less sharply defined than in true miliary tuberculosis, nor do they usually extend so fully to the peripheral portions of the lung fields. Again,

miliary tuberculosis may be simulated by the passive pulmonary congestion (with enlarged hilar shadows) of advanced mitral stenosis. I have not seen among children a case of Boeck's sarcoid or of Löfller's eosinophilic lung, both of which are said to produce a miliary lung picture. There is another pulmonary condition which, because of the widespread changes (apices to bases being equally involved, with infiltration extending to the periphery) may enter into the X-ray differential diagnosis of pulmonary tuberculosis in childhood. I refer to the lung changes seen in fibrocystic disease of the pancreas. These pulmonary changes appear to be due essentially to a mucoviscid bronchial secretion which produces lobular obstructive emphysema and atelectasis, complicated by a super-added infection. In Melbourne our attention has been focused on this far from infrequent disease by the work of Dr. David Pitt and Dr. Peter Blaubaum, of recent years resident medical officers at the Children's Hospital.

The term "epituberculosis" is in disfavour nowadays, mainly because it is generally held that its pathogenesis is not that which was described by its authors, Eliasberg and Neuland, who coined the term twenty-eight years ago. But if we restrict the term to a clinico-radiological syndrome, there should be less objection to the continuance of its use. The radiologist is interested in this condition, because his series of films plays the most important diagnostic part. The epituberculosis syndrome may be described as a clinically benign, and radiologically persisting, though ultimately resolving, extensive pulmonary opacity in children infected with tuberculosis. The consolidation is persistent, for it is evident on the X-ray films for many weeks—benign, because eventually it is absorbed, little or no evidence of its former presence being left on the film, except perhaps a little nodule like a Ghon's tubercle or a thickening along the interlobar fissure. This happy end result of no cavitation, no great fibrosis, is different from what is usually expected with extensive tuberculous consolidation. Many such opacities have in the past twenty years been proved to be the result of bronchial obstruction due to enlarged hilar glands or intramural tuberculous tissue; but on the other hand, British paediatricians of the calibre of Spence (of Newcastle) and Parsons (of Birmingham) hold that some at least of such opacities are due to true tuberculous or allergic consolidation, as was believed by Eliasberg and Neuland. In the presence of pulmonary collapse, the radiologist would expect the opacity to be smaller (or retracted) at the hilum, and the heart and mediastinum displaced to the affected side, with perhaps some elevation of the corresponding diaphragmatic dome. But such X-ray signs are not always present in the syndrome—not, of course, that this absence vitiates the atelectatic explanation, though one would expect after such a long-standing collapse that extensive bronchiectatic changes would more frequently result. Often the base of the shadow is at the hilum, its apex at the periphery (producing an appearance known as Sluka's triangle); the shadow clears slowly from the periphery, such a manner of clearing as would not be expected in collapse. At all events, the recognition of this syndrome has shared in dispelling the pessimism displayed in the past that an extensive and persistent pulmonary consolidation in a tuberculous child was necessarily of grave import, and indirectly has focused attention on pulmonary collapse as a complication of tuberculosis.

There are few areas of the body which demand a more careful attention to technique than the child's chest, and I hold strongly to the opinion that interpretation should not be attempted unless the films presented for inspection satisfy the canons of first-class radiography. All radiologists, but perhaps not all physicians, are acquainted with the extreme difficulty of taking satisfactory films of obstreperous young patients; skill, patience and adequate assistance are required, in addition to apparatus of abundant output equipped with modern timing devices. Even though time, that often can be ill spared, is required for the necessary dark accommodation, it is frequently well worth while preceding the taking of the films with fluoroscopy. Certainly fluoroscopy plays a far less important part in the demonstration of parenchymatous lesions

than do properly exposed films, but it often differentiates real from apparent broadening of the cardio-vascular-mediastinal shadow, and will just as frequently help in determining the degree of rotation necessary for the optimum demonstration of a lesion on the film. The films must be taken in full inspiration, or as near to this phase as is practicably possible. The postero-anterior view is used for older children and the antero-posterior view for the younger. The target-film distance should be at least four feet, and for older children the sitting or erect posture is preferable to the recumbent. The tube should have a rotating anode, and the time of exposure should never be more than $\frac{1}{100}$ second. The films should be of optimum radiographic density and never under-exposed—though sometimes over-exposed films serve a purpose by making calcium deposition the plainer. In all cases in which time and expense allow, I believe lateral views should be taken, and sometimes oblique views are necessary. Frequently apparent enlargements of the hila are shown by the lateral view to be due to deposits lying in the lung parenchyma, well anterior or posterior to the hila. On the antero-posterior view, they appear as perihilar extension, because they happen to be on the same horizontal level as the hila. There may be little or only a vague clue to collapse of the middle lobe in the antero-posterior view, but the lateral view will demonstrate the condition clearly; similarly are revealed the interlobar lesions of effusion or pleural thickening. Deposits anterior or posterior to the obscuring cardiac shadow can be shown only by lateral or oblique views, as can those which lie in the bases of the lower lobes below the levels of the diaphragmatic domes.

Whenever possible, interpretation from wet films (except of the most tentative nature) should be avoided; the reflections of even daylight thrown on wet films can be most misleading. The great value of comparative films, taken at various times during the course of the disease, needs no emphasis. Mass photofluorography is of little use for children below that age at which they can be readily instructed and confidently trusted to hold the breath in full inspiration. From the radiological viewpoint, one would suggest that, if it is only pulmonary tuberculosis which is being sought, with children it is better first to determine the Vollmer or Mantoux reactors and later take large films of these only, than to engage in mass photofluorographic surveys in which there may be a large percentage of technically unsatisfactory microfilms. Another consideration is that in Victoria a large percentage of children is being found to give a negative response to tuberculin tests. In my view, microfilms are not a practical proposition for children aged under four-years.

Conclusion.

It can thus be seen that in the examination of children's chests, as in other branches of diagnostic radiology, rushed or cheap radiology almost invariably means poor radiology. An adequate number of films, adequate time and patience, and competent technical assistance, are all essential for a satisfactory investigation, and I have found that it takes considerable experience for even the keen and intelligent technician to become proficient in this difficult branch of radiography.

The radiologist is the guardian of sound technique and sound interpretation, and is the specialist assessor of one particular physical sign—namely, radiological inspection. Only rarely can he, by his own devices, be translated to that ethereal sphere of the unerring diagnostician. But let it not be assumed that radiologists exhibit excessive humility. In one of Henrik Ibsen's plays, "The Pillars of Society", is written: "Truth is no Methuselah; an ordinary well founded truth lives twenty, at most thirty, years".

Many have lived long enough to see radiology advance beyond our most optimistic dreams; and who knows but that a future radiation will not eventually reveal on a future film, for all to see, the actual *Mycobacteria tuberculosis* lying in their endothelial fastnesses?

RADIOLOGICAL INTERPRETATION AND PULMONARY TUBERCULOSIS IN THE ADULT.¹

By R. M. DE LAMBERT,
Sydney.

ACCURATE diagnosis and satisfactory management of cases of pulmonary tuberculosis demand that the clinician be in possession of considerable and varied information. Such information is available from a variety of sources as the result of the application of many different clinical methods and technical procedures.

It is the task of the clinician, be he physician or surgeon, to ensure that all relevant information in regard to each case is obtained and correlated, and that due weight is accorded each observation.

This is a continuous process; new information becomes available day by day, and management of the case is varied accordingly. Some of this information is available to the clinician as a result of his or others' direct observations—the historical background, the symptomatology, the presence or absence of physical signs. The accuracy of the observations will depend on several factors—the veracity of the patient, the technique of the observer—and the careful clinician satisfies himself about such things before he draws conclusions.

Other information is available indirectly, often as the result of highly complicated technical procedures, the details of which may be outside the field of knowledge of the clinician. For instance, a specimen of sputum may be subjected to complex chemical, physical and biological treatment with a view to demonstrating the presence or absence of tubercle bacilli. This is the work of a specially trained technician and culminates in an observation by a specially trained observer. The clinician may be advised that bodies having the form and staining reactions of tubercle bacilli have been observed microscopically in the centrifuged deposit of the chemically treated sputum, or that bacterial growth has occurred on a particular medium, or that a guinea-pig has developed lesions characteristic of tuberculosis following inoculation and that organisms having similar features have been recovered from the lesions. On the other hand, one or other of these procedures may have failed to reveal such organisms.

He must know the significance of the various possibilities. He must know the chances of error in both directions in order that he can interpret this information correctly, attach due weight to it in association with other (perhaps conflicting) information, and so make correct decisions regarding the patient's welfare. To this end he will consult a pathologist who has studied these complex procedures in detail and obtain from him information as to their degrees of accuracy, fallacies *et cetera*, together with the significance of the various findings from a pathological viewpoint. With this information, the clinician can afford to ignore the detailed technicalities of the procedure and regard only the result, according to due clinical significance in relation to all the other information.

Other indirect information is available to him as the result of radiological study of the chest. For this a variety of complicated equipment and techniques is available, their use depending on the features of the case and the information desired. It constitutes a highly skilled task for a specially trained technician and again culminates in an observation by a specially trained observer, who, although he has a medical training and may have an extensive knowledge of medicine and pathology in relation to the chest, is nevertheless primarily an observer in this case. He will be called upon to use his medical knowledge in interpreting his observation and in thus providing the clinician with information of a slightly different order. He may be in possession of other information in relation to the case, and if so it is important that this does not

¹ Read at a combined meeting of the Section of Public Health, Tuberculosis and Tropical Medicine, and the Section of Radiology and Radiotherapy, Australasian Medical Congress, British Medical Association, Sixth Session, Perth, August, 1948.

bias his observation, but is used only in interpreting it to the clinician.

The actual observation of the radiologist is a visual one, which may occasionally be supplemented by his tactile sense. He makes it in two widely different circumstances, on a fluorescent screen and on a photographic film. In each case he observes a more or less complex pattern of light and shade. In the case of fluoroscopy the light intensities are low and movement may be observed. In the case of the radiograph, normal light intensities are used to observe a still picture. The two methods provide different information, which is often complementary. Although in each case observations are made as the result of visual stimuli, widely differing mechanisms are involved as far as the eye is concerned, and it is important that the possibilities and limitations of each method be appreciated. In the case of fluoroscopy, low intensities to which only the retinal rods are sensitive are used. Under these circumstances the resolving power of the eye is poor, as is the ability to perceive differences in contrast. Use of the yellow-green portion of the spectrum and a completely dark-adapted eye provide optimum conditions; but it is important to realize that even so contrast perception and resolving power are of a very low order indeed.

In the viewing of a radiograph, optimal light intensities to which the retinal cones are sensitive may be used. Contrast perception and resolving power are greatly improved, but still have their limits.

Although it is not essential for the radiologist to have a detailed knowledge of the manner of working of his machine, it is imperative that he know how his fluoroscopic and photographic images are formed if he is to interpret them correctly. Such knowledge is equally necessary on the part of the physician or surgeon who is going to view fluoroscopic or radiographic images and draw conclusions from his observations.

When X rays strike matter they are changed quantitatively and qualitatively by being scattered and absorbed. They obey complex physical laws; but broadly it may be said that the extent to which a body impedes the passage of X rays is determined by (i) its atomic structure and (ii) its density. The higher the effective atomic number and the greater the density, within the limits of human tissues, the greater are the absorption and scattering effect on the primary beam.

If advantage is taken of the photoelectric effect of the emergent X rays, it is possible, by the use of a fluorescent screen or photographic film, to observe within the limits of the screen or film used the manner in which a beam of radiation has been altered in its passage through a substance. It is then permissible to draw conclusions as to equivalent atomic composition and density of the structure irradiated.

The thorax presents a variety of tissues of complex atomic structure and density. Fortunately, for practical purposes, it may be regarded as consisting of (i) calcified tissues, which vary slightly in density, and (ii) soft tissues, which also vary slightly in density with the notable exception of the lungs.

The calcified tissues contain atoms of relatively high atomic number and so cause greater attenuation of the X-ray beam. Unless the energy of the incident radiation is sufficient to penetrate calcified tissues, there may be failure to demonstrate soft tissue structures on either side of the ribs in the axis of the radiation. The energy of the radiation, or kilovolt peak, should thus be governed by the extent to which it is desired to "see through" the ribs and not by the overall thickness of the chest. Variations in density within calcified tissues permit observation of their internal structure.

The soft tissues are made up of atoms of uniformly low effective atomic number except for insignificant traces, and the extent to which they can be displayed radiographically is therefore dependent entirely on variations in density. With the exception of the lung and to a lesser degree fat, soft tissues vary little in density and so do not lend themselves to radiological examination unless a contrast medium is used. In the case of the lungs, however, the presence of a varying proportion of air renders conditions ideal. Air

may be ignored as far as absorption and scattering of X rays are concerned radiographically, and therefore acts as a contrast medium. Whenever there is a variation in the air-tissue ratio in the lung, there will be a proportionate variation in the light intensity on the fluorescent screen or in the photographic density on the film.

Except for the effect of calcification, which has already been referred to, and except when opaque contrast media are used, it is this air-tissue ratio and this only which is responsible for the radiographic appearances of the normal or diseased lung. Consolidation, atelectasis, emphysema, fibrosis, hyperæmia *et cetera* all result in an alteration of the normal air-tissue ratio and so produce a radiographic effect.

The radiologist in the course of his training and experience comes to associate certain radiographic appearances with certain diseases, and some radiologists on the basis of such experience confidently make a diagnosis as a result of their observations. Alternatively they may state that a certain pathological process exists, or even that certain bacteria are present. It is obvious that there can be no justification for definite statements of this nature when one considers the underlying basis of the radiologist's observation. As is well known, different diseases and different pathological processes may be indistinguishable macroscopically and even microscopically at the post mortem examination, and radiography of the lungs is hardly comparable as a method of observation.

The clinician without any special knowledge of the basis and limitations of radiology as applied to the chest is apt to attach disproportionate weight to the radiologist's report, even to the extent of regarding it as a basis for a diagnosis and so obviating the need for obtaining and correlating relevant bacteriological, immunological and clinical information. Very many erroneous diagnoses are made in this way with far-reaching effects as far as the patient is concerned, and frequently the radiologist remains unaware that he has in large part been responsible. At the time that a radiological report is written it cannot be forecast by whom it will be read and interpreted; often one is alarmed to find the patient making the final judgements. It is therefore important that it be so worded as to be usefully informative without being unjustifiably dogmatic.

On the other hand, the clinician with a knowledge of the basis of radiography will view such radiological diagnoses with scepticism, and he will be even more sceptical when the information which he has obtained from other sources does not agree with the radiologist's diagnosis. He will tend to regard either the method as of rather limited usefulness or the radiologist's opinion as of little value. This is unfortunate, because the method correctly used can provide accurate information not otherwise obtainable in the living patient, and the radiologist, with a correct appreciation of the extent to which his observations may be translated into terms of disease and pathological processes, may be of inestimable help to the clinician by virtue of his experience and as a skilled observer and interpreter of radiographic appearances.

The radiologist with a knowledge of the pathology of pulmonary disease and of resulting radiographic appearances, having described qualitatively and quantitatively what he has observed, may justifiably draw certain conclusions and make suggestions as to the presence and location of a disease and also as to its nature. He is seldom justified in making a pathological diagnosis, however, and surely never a bacteriological or histological diagnosis.

The radiologist may at the time of radiological examination be in possession of clinical and bacteriological information regarding the case which permits of a definite diagnosis. However, it would seem desirable for him to record his observation first to avoid any possible bias, and subsequently in the light of the additional information elaborate his opinion.

It is necessary that the radiologist be acquainted with all relevant clinical information at the earliest practicable time in order that he may correlate his observations with the actual disease process found to exist; this is particularly desirable whenever the opportunity to study macroscopic and microscopic appearances occurs.

Pulmonary tuberculosis as it occurs in the adult results in an infinite variety of radiographic appearances. In the interpretation of these appearances it is necessary to bear in mind the information which will be useful to the clinician in his diagnosis and management.

The location and extent of the pathological process can in most cases be accurately defined. Special views and methods may be necessary—for example, lordotic lateral and oblique views, exposures made with a Bucky grid, stereoscopic views and tomography. The required technique will usually be apparent from study of the initial postero-anterior radiograph, although fluoroscopy is often helpful in this connexion.

The character of the pathological process can often be inferred from the radiographic appearances. Consolidation, hyperemia, atelectasis, emphysema, fibrosis, calcification—all present more or less characteristic appearances, although lesions in which a combination of these processes is present may be confusing. Caseation is not usually distinguishable radiographically from consolidation. An acinar or lobular distribution of a lesion may often be determined, as may the tendency of separate lesions to remain discrete or to coalesce. Cavitation when present is often recognizable in routine views, but is often demonstrated only by a special technique such as tomography. Pleural thickening is apparent when displayed tangentially, and may be suggested by a generalized or local "veiling". Retraction of a lobe or lung as a result of permanent damage to the parenchyma is usually accompanied by falling in of the overlying ribs, with narrowing of the intercostal spaces, displacement of the mediastinum and elevation of the diaphragm, separately and together; often compensatory over-expansion or emphysema of unaffected portions of the lung is present.

Abnormalities of the trachea and main bronchi such as displacements and dilatations may sometimes be suggested in routine views. By tomography it is possible accurately to study the main subdivisions of the bronchial tree. Occasionally it may be considered desirable to use lipiodol as a contrast medium.

The observation of progress of the disease following its discovery is perhaps, with the initial observation of a lesion, the most valuable application of radiology to adult pulmonary tuberculosis. In this type of examination technique is all-important. Unless exactly the same radiographic quality is achieved at successive examinations, any observations may be prejudiced. This implies more than mere duplication of exposure factors, even if the serial examinations are being made on the same equipment. The same brand and quality of film must be used, the same type and speed of intensifying screens, the same tube-film distance and posture, a comparable effective focal spot size, as well as the same time, effective kilovolt peak and milliamperage. Processing solutions should be of the same brand, and a correctly standardized time, temperature, age and agitation processing technique should be followed.

Although it seems so obvious, it is necessary to mention that the films must be viewed on the same or equivalent viewing boxes.

To achieve comparability of serial chest radiographs is a difficult and exacting task and requires the best of equipment and personnel. It cannot be done hurriedly. The use of a standard step wedge on one corner of the radiograph is an excellent check and a useful guide if a serial film is to be made in the absence of any knowledge of the technical factors used for the original. Comparison of radiographs obtained in this way permits observations in relation to changes in site, extent and character of the lesions.

One should always exclude the possibility that altered sharpness of definition of the components of a lesion may be due to different technical factors such as focal spot size, tube film distance, screen contact, speed or exposure time. The internal architecture of the ribs provides a satisfactory basis for comparison. It is in this field particularly that the careful and unbiased observations of an experienced radiologist may be of great assistance to the clinician. It is important that in actually making his observations the radiologist confines himself to what is permissible within

the limits of the method which he has used. It is equally important that he be able subsequently to correlate his observations with other evidence of progress. The clinician with a personal and detailed knowledge of all the aspects of the case is less able to interpret the appearances objectively and with an unbiased mind. However, he should appreciate the ability of the experienced radiologist to do so, although he will for the sake of completeness view the films himself and ideally discuss the appearances with the radiologist if they reveal points of special interest or appear to provide conflicting evidence.

Correlation of actual pathology with radiographic appearances is still far from being clearly defined, and close collaboration between the morbid anatomist and radiologist is necessary in order that progress can be made in this direction. Post-mortem radiography is of immense value in this connexion, and although the not infrequent location of the hospital X-ray department in the vicinity of the morgue has probably resulted from other considerations, there is much to be said for such an arrangement.

There is a great need for museums which correlate morbid anatomy and histology with radiographic appearances.

The radiologist with his specialized technical knowledge must always be ready to apply new and different technical methods in an endeavour to display more satisfactorily pathological processes in the living subject. In this connexion the collaboration of a physicist with a knowledge of the problems involved is of great value.

The last few years have seen amazing and revolutionary technical advances, many of which have resulted from the application of radiology to industry. Few of these have as yet been applied to medical radiology, and it may be confidently stated that the immediate future will see revolutionary changes as far as the application of radiology to the chest is concerned. Two examples may be mentioned in illustration. It is theoretically practicable by means of electrostatic acceleration of electrons to amplify the fluorescent screen image to the extent that light intensities within the range of perception of the retinal cones become available. This will mean that the observer of the screen image will be able to resolve images and perceive contrasts of the same order as are at present available in the radiograph.

Effective focal spots of 0.3 square millimetre permit "enlargement" techniques to be employed without loss of definition. The object tube distance is reduced and the object film distance increased. An enlargement of several diameters is possible in this way.

As medical men we tend to be rather too complacent, to regard our present methods of investigation as perfect and more or less complete in themselves. This is an unhealthy attitude, and as far as radiology of the chest is concerned—and particularly in the case of pulmonary tuberculosis—it can be corrected only by the closest collaboration of physician, surgeon, pathologist, physicist, technician and radiologist, each endeavouring as far as he can to understand the problems of the other and using his special knowledge to solve them. The end in view must always be the welfare of the patient through greater knowledge of his disease.

Summary.

1. The correlation of information derived from many sources is necessary for the accurate diagnosis and satisfactory management of pulmonary tuberculosis. Radiology represents one important source of such information.

2. An understanding of the way in which radiographic images are formed is essential if the applications and limitations of the method are to be appreciated and correct inferences drawn from observations made. Brief reference is made to the basis for the formation of radiographic images.

3. Radiology does not provide a basis for definite bacteriological and histological diagnosis; attempts to make such a diagnosis on radiological evidence may prejudice the method as far as those unfamiliar with its limitations are concerned, and have resulted in many erroneous diagnoses.

4. The extent to which information is available in relation to the diagnosis and management of pulmonary tuberculosis in the adult as a result of radiological investigation is briefly surveyed. Particular reference is made to the use of radiology in the observation of progress of pulmonary tuberculosis.

5. It is considered that there is a lack of satisfactory correlation of pathology with radiographic appearances as far as pulmonary tuberculosis is concerned, and collaboration between pathologists and radiologists, post-mortem radiography and museums which correlate the two sets of observations are suggested as correctives.

6. It is considered that there will be revolutionary changes as far as the application of diagnostic radiology to the chest is concerned, as a result of technical advances currently in progress.

PULMONARY TUBERCULOSIS IN THE ELDERLY.¹

By KEITH H. HALLAM,
Melbourne.

ONE must approach tuberculosis in the elderly with the same attitude as tuberculosis in any other age group: commence with inference, pass to supposition, and progress to proof. I have therefore made four arbitrary headings: (i) the "possibles" (culled from the phantoms—microfilms); (ii) the "probables" (culled from patients); (iii) the "positives" (culled from post-mortem examinations); (iv) the proof (culled from pathological specimens).

The "Possibles".

The "possibles" are examinees who may be suffering from tuberculosis because the phantoms (microfilms) reveal shadows which stimulate further investigation in respect to this disease. Statistics from this source are alarming. In Adelaide a micro-radiological survey of chests revealed a possible 6% incidence of tuberculosis in the lungs of 5000 examinees over the age of forty-five years. In a similar survey at South Melbourne the incidence was 5.7% in 1000 examinees. Most of these people had lesions which did appear to be old tuberculous infections; but we are all aware that recrudescence may occur at these apparently static foci when intercurrent diseases arise. I vividly recall Dr. J. D. Hicks's histopathological presentation recently at the Prince Henry's Hospital, showing a calcified nodule and associated newly-formed giant cells in the lung of a patient who had died of bronchial carcinoma.

The "Probables".

The "probables" are the elderly patients whom, in the normal course of the practice of radiology, one finds to have pathological changes in their lungs consistent with tuberculous infection. These cases may be discovered because referring doctors suspected tuberculosis, or they may be found fortuitously during some other form of X-ray examinations—for example, barium meal examinations. These "probables" are our big problem, because of the difficulty in establishing a diagnosis and in determining the infectivity and the course of the tuberculosis if present.

I shall discuss first the course—progressive or regressive—and the stabilization or resurgence of the disease. These, as you know, depend on the virulence and number of the infecting organisms, the native and acquired resistance, the hypersensitivity of the patients, and the tissues in which the infection occurs. In general the radiologist cannot bring the factors of virulence and number of organisms into his calculations, but in discussing pulmonary tuberculosis affecting those who are not young, he can reasonably talk in terms of resistance, hypersensitivity and tissues. The whole aspect of the subject

is illumined by a study of these factors when we are groping for explanations of this and that in films showing tuberculous infections of the lungs. Dr. Macdonald has told you of the problems in the young, in whom the disease is usually exudative, widespread and glandular, in contradistinction to the typical adult infection in which fibrosis and little or no glandular caseation are the rule.

The aged may possess a sum of native and acquired resistance to tuberculosis; but on the debit side is a decrease in their general resistance because of their sedentary habits, and because of the undermining of their powers by other diseases. Native resistance is the child's first line of defence, and so, when this is broken down, caseation and general spread of the disease are the rule in so-called clinical tuberculosis. In aged patients a chronic tuberculous infection may be stimulated after the acquisition of other serious diseases to progress to caseation and miliary spread; that is, a reversion somewhat to the course of the disease in infants. This question of the total resistance in the various age groups is important, because the higher we go in the sequence of decades the more people we find infected in either a clinical or non-clinical form. Acquired resistance in adolescents, particularly in those subjected to infection risks, develops rapidly. Among 378 students controlled by Mantoux tests and X-ray examinations during their medical courses by Lowe and Hallam, it was found that the Mantoux test produced a positive result in 30% in the preclinical years with no incidence of infection detectable by X rays. In their clinical years as students at public hospitals the incidence of pulmonary tuberculosis was 2%, but the positive Mantoux reactions were doubled; when contact (presumably on a massive scale) was made, eight contracted clinical tuberculosis and the positive Mantoux reactions went up 100%. In the decades beyond the adolescent stage up to middle age infection increases and so does individual resistance, for two reasons apparently: firstly, because many with low resistance have fallen by the wayside, and secondly, because the longer people live the greater is their chance of being infected and of building up acquired resistance. We have the following anomaly, however, which is of great importance both to the public health officer and to the radiologist, for here they can meet on common ground in respect to tuberculosis in the aged. In infancy 0.5% are infected, but 5000 per 100,000 of those infected die from tuberculosis. By the time the third decade is reached 55% are infected, with a death rate of 90 per 100,000. In the fifth decade the zenith of infection percentage is reached, and remains stable to the highest age group: that is, 95% of the population between the ages of forty five and ninety years have been infected with tuberculosis, but in the fifth decade the death rate has dropped to a minimum (exclusive of the five to fifteen years age group, who are well known to be almost immune to pulmonary tuberculosis in a clinical form) of 66 deaths per 100,000, while the death rate in the last decades of the human life series has risen to approximately 90 per 100,000; that is, with an equal infected percentage the death rate has risen by 33%. One might say that naturally the death rate from tuberculosis among elderly people must of necessity rise, because there must come a time when these people die. I emphasize the fact that old people die with tuberculosis in addition to those who die from tuberculosis. It is reasonable to assume that most elderly people who die with or from tuberculosis die from the pulmonary form of the disease. Most or all of such patients if radiologically examined would be shown to have shadows in the lungs suggestive of infection with Koch's bacillus. Health officers and radiologists must combine in a campaign of insistence that in future all such subjects be radiologically examined. Some agents in senility and diseases other than tuberculosis lower the specific resistance of the aged, and it is probable that many quiescent infections are reactivated by these factors. If we cannot radiologically examine the chests of all the elderly people in the community in the near future, it is extremely urgent that we radiologically examine all elderly patients occupying hospital and other institutional beds, and also all elderly outpatients. I understand that all patients at the Royal Perth Hospital do have their

¹ Read at a combined meeting of the Section of Public Health, Tuberculosis and Tropical Medicine and the Section of Radiology and Radiotherapy, Australasian Medical Congress (British Medical Association), Sixth Session, Perth, August, 1948.

are chests radiologically examined. The platitude that the undiscovered aged sufferers from pulmonary tuberculosis are the main spreaders of the disease is a horrible truth.

With regard to the tissue in which the infection occurs, one is not referring to specific tissues of individual organs, but to the condition of the tissues of the lungs in elderly people. We are aware that tuberculosis is prone to make headway in lungs distorted and debilitated by the effects of silicosis—that is, fibrosis and emphysema. The lungs of all city dwellers are affected in the same way to a lesser degree, and many elderly people have had infections such as pneumonia, the exanthemata (in early life) and other lesions such as virus infections, which have lowered the tissues' resistance over the years. Latent infections of tuberculosis, bound up in fibrous nodules, may reawaken and spread in a devitalized patient with poorly resistant lungs. It is suggested that all elderly people who do contract pulmonary diseases should be controlled by serial X-ray films of the chest in case latent tuberculous infection lights up.

The differential diagnosis of lesions in the lungs of elderly people presents a difficult radiological problem.

Tuberculosis in the aged may be chronic fibro-cavernous, pneumonic or miliary, or a combination of these. The shadows presented cannot with certainty be distinguished from various malignant effects, subacute pneumonic infections, syphilis, bronchiectasis and many less common diseases.

Great difficulty and error in diagnosis may be caused by the exhibition of old tuberculous lesions in the lungs or the pleura. These may be red herrings, and may lead the radiologist to assume that a recent lesion is also tuberculous when it may be of some different origin and have no relation to the old lesions.

The "Positives".

The "positives" for the purpose of this paper are those who are found with pulmonary tuberculosis at post-mortem examination. At the Royal Melbourne Hospital I examined 453 consecutive autopsy reports. The deceased patients were divided into age groups: 111 were aged under fifty years (and with these we are not concerned), 106 were between the ages of forty-nine and sixty years, 115 were aged between fifty-nine and seventy years, and 121 were aged seventy years and over. Ten cases of pulmonary tuberculosis were recorded—three in the forty-nine to sixty years group, six in the fifty-nine to seventy years group, and one in the seventy years and over group. This gives an incidence of 2.9% pulmonary tuberculosis in those aged fifty years and over who died at this hospital. If we assume that there is a comparable number with tuberculosis amongst those who die but do not come to autopsy. A similar survey at the Prince Henry's Hospital gave the following results: eight cases of pulmonary tuberculosis were found in autopsies of those aged fifty years and over—one in the forty-nine to sixty years group, two in the fifty-nine to seventy years group, and five in the "over seventies". Amongst 254 post-mortem subjects, 42 were aged under fifty years, 53 were aged between forty-nine and sixty years, 75 were aged between fifty-nine and seventy years and 84 were aged over seventy years. Here the incidence of pulmonary tuberculosis was 3.8% among those who died at the age of fifty years and over.

The above statistics in no way represent the proportion of elderly tuberculous patients in these hospitals. They merely point the accusing finger at a source of infection for those who attend to patients in public hospitals. This source of infection could be cheaply and effectively dried up by appropriate radiological examination of chests. As a rider to these post-mortem figures I mention a potent cause of infection among the general population (Dr. H. M. James, Clinical Tuberculosis Officer, has kindly supplied me with these figures): 60 known and recently discovered subjects of pulmonary tuberculosis between the ages of fifty and eighty years and primarily detected by X rays are on the waiting list for admission to sanatoria in Victoria.

The Proof.

For the proof we have the pathological specimens.

Conclusion.

In conclusion, my objective has been to state a case for the widespread use of X rays in eliminating a dangerous source of infection in the community, and to insist upon the great difficulty of interpreting X-ray films which show pathological changes in the lungs of elderly people. Impulsive assumptions that such shadows do or do not represent tuberculous infections cannot be tolerated; but this must not deter us from making every effort to safeguard young people from this scourge, and incidentally must not deflect us from an opportunity to institute treatment for aged sufferers from tuberculous infection—an added affliction to many in their declining years.

Acknowledgements.

My thanks are tendered to Dr. Edgar King and Dr. J. D. Hicks for making records available.

TOMOGRAPHY AS AN AID IN THE DIAGNOSIS AND TREATMENT OF PULMONARY TUBERCULOSIS.¹

By ALAN KING,
Perth.

TOMOGRAPHY or body section radiography is a radiographic technique which is particularly applicable to the study of diseases of the lungs.

I do not think that tomography in any way replaces the normal postero-anterior film, the lordotic film, the oblique film, the Bucky film or the stereo pair, but rather that it is a complementary method, useful in some instances. At the same time, I feel that the value of tomography is not yet fully realized in Australia. As has been stated by Young,⁽²⁾ "it should be employed in every chest problem not solved by conventional methods".

It is possible to obtain a lung section radiograph at any desired depth and to view the lung at this plane with the minimum superimposition of the rest of the lung and the thoracic cage. Anatomical detail can be more clearly distinguished than in an ordinary film and the main bronchi followed into their larger subdivisions.⁽³⁾

Our use of the tomogram has been almost exclusively in the study of pulmonary tuberculosis, and we find it possible to confirm its usefulness in four main groups, now to be discussed.

Diagnosis and Differential Diagnosis.

Tomography may be used as an aid in diagnosis when pulmonary tuberculosis is suspected but its manifestations cannot be seen in ordinary films. A good example of this is the cavity at the extreme apex of the upper lobe, obscured by the bony cage.

Tomography may be occasionally useful in differential diagnosis. At times it is not always possible by ordinary methods immediately to differentiate a lesion of pulmonary tuberculosis from other conditions such as a pulmonary neoplasm. On such occasions tomography may provide suggestive evidence that may be correlated with findings from other investigations such as bronchoscopy.

Type of Disease.

Tomography may help to indicate to the physician the type of tuberculous disease present. It may help to analyse the complex opacities seen in the ordinary film. Cavities may be exposed in a mass of fibrous tissue. Traction and distortion of the trachea and bronchi are often more clearly visualized. Disease may be interpreted as healed or fibrotic at one level, whereas fresh active exudative disease may be disclosed at another level.⁽⁴⁾

Anatomical Localization.

More accurate anatomical localization of disease is possible by tomography—for example, in the case of an apical cavity seen on the postero-anterior film, but obscured on the lateral film.

¹ Read at a combined meeting of the Section of Public Health, Tuberculosis and Tropical Medicine and the Section of Radiology and Radiotherapy, Australasian Medical Congress (British Medical Association), Sixth Session, Perth, August, 1948.

In assessing the indications for treatment in pulmonary tuberculosis it is now more important to localize the disease accurately to the affected broncho-pulmonary segment or lobe.

The situation and extent of disease or cavitation may well decide whether artificial pneumothorax, lobectomy, thoracoplasty, Monaldi drainage before thoracoplasty, or pneumonectomy is indicated.

Thoracoplasty and Empyema.

After the operation of thoracoplasty, when the ribs grow again in the form of an irregular carapace, it may not be possible to see the underlying lung.

If sputum containing tubercle bacilli persists, a series of tomograms may reveal a cavity that has not closed in the collapsed portion of the lung.

The presence of thickened pleura and fluid in the pleural cavity may similarly obscure detail; for example, in tuberculous empyema it may be important to determine whether atelectasis is present or not, or how much lung tissue is still aerated.

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- (1) R. Young: Writing in "A Manual of Tomography", by M. Weinbren, 1946, page 11.
- (2) S. Nowell: "Value of Tomography in Lesions of the Main Bronchi and their Larger Subdivisions", *Proceedings of the Royal Society of Medicine*, Volume XL, 1947, page 399.
- (3) E. Haefflinger: "Tomography in Pulmonary Tuberculosis", quoted in *American Review of Tuberculosis*, Volume LVI, 1947, page 132.

STANDARDIZATION OF APPARATUS AS AFFECTING RADIOLOGICAL INTERPRETATION.¹

By C. E. EDDY,

Commonwealth Radium and X Ray Laboratory,
Melbourne.

It was with due appreciation of the honour being conferred on me that I accepted the invitation of your committee to give a paper at this discussion. The title which was suggested particularly appealed to me because I feel that, in the radiological interpretation of pulmonary tuberculosis, there is urgent need for standardization of apparatus if there is to be the greatest return for the effort expended.

It is well to consider first what is meant by standardization or the adoption of a standard. The word "standard" is given many meanings in "The Oxford English Dictionary"; the one significant to our discussion today can be taken as "a definite level of excellence, or a definite degree of any quality, viewed as a prescribed object of endeavour or as a measure of what is adequate for some purpose". If we accept this meaning, then standardized X-ray equipment should make possible the production of radiographs of a definite quality which will most adequately reveal all the essential details of the lung tissue, whether normal or abnormal.

Before it is possible, from the physical and engineering aspects, to prescribe a satisfactory type of standardized equipment, it becomes necessary for the radiologist (possibly with assistance from the physicist) to specify the "definite quality" which should characterize a radiograph of the chest. Until a few years ago it would have been indeed a brave man who would have suggested the adoption of a standardized type of radiograph. Even today, when the suggestion is being favourably received in most quarters, there is still great difficulty in obtaining agreement as to the "definite quality" of radiograph which should become the standard.

The ideal radiograph of the chest should show lung tissue clearly from apex to base. The shadows of the ribs (both underlying and overlying) present particular problems if the tissues are to be traced through areas of rib overlapping. The wide range of densities to be recorded

over a chest requires a photographic film with a wide latitude, and this in general cannot be obtained in association with high contrast. Further, provided an exposure timer of adequate sensitivity is available, the use of a higher voltage (up to 100 or even 120 kilovolts) will cause the ribs to appear more transparent without losing detail in the soft tissue. The ideal radiograph may not have the "sparkle" and high contrast of many of the older type of films, but a careful study will show that all required tissue detail is recorded.

The ideal radiograph should also be of a fixed average density, and this value of density should be reproducible at will. The photoelectric exposure timer now makes it possible to reproduce densities very closely, but the choice of the absolute value of the density must be made by the radiologist. Here again old ideas are changing; detail is often most clearly registered with a reasonably dark film viewed against a more intense illuminator, but is not observable against a weak illuminator. On the other hand, films produced for reading against a weak illuminator are invariably of such a low density that the full range of tissue structure is not registered.

It seems possible that the dissatisfaction now being expressed about the older type of radiograph may be due to the fact that, as a result of miniature radiography and an increasing general consciousness regarding tuberculosis, a much higher proportion of early lesions is being recorded. There is evidence that the early lesion, being smaller in cross-section as well as in depth, produces a much smaller change in density than an advanced lesion, and thus requires more careful radiographic procedure to ensure clear registration.

In my opinion, the choice of the most satisfactory radiographic conditions can be made only as a result of a comprehensive series of investigations. A beginning of such an investigation has been made in this laboratory and the method shows promise. Initially, a film in which an early lesion in lung tissue has been detected is selected, and measurements are made of the film densities within the area of the lesion and in the adjacent healthy tissue. It is then possible to construct a phantom of unit density material (for example, cane fibre) which under the radiographic conditions under which the film was made gives density values corresponding to those of the lesion and of the healthy tissue. By the use of this phantom, a range of radiographic, film and processing conditions can be examined to select those which most clearly demonstrate the artificial lesion in the phantom. A further investigation of the most suitable combination of film density and intensity of illumination in the viewing box can then make possible the complete prescription of the most satisfactory conditions for a radiograph of the highest technical quality (the criterion of technical quality being the demonstration of a known defect rather than the overall appearance of a film). Some progress has been made in this direction, and specimen radiographs of both the screen and the non-screen type have been produced. It must, however, be admitted that the first reaction of most radiologists in viewing these films is one of doubt, because they differ so much in general appearance from those to which they have been accustomed, and much careful educational work is required before a chest film will be produced which will be accepted unanimously as being of the "ideal" quality. It is, however, being realized to an increasing extent that the wide range of quality between films produced in different institutions is so great that they cannot all fall within the definition of an "ideal" quality.

When the radiologists have agreed upon the ideal quality of a chest film, it will be a relatively easy matter to produce such films on any type of equipment. Sufficient experimental work has been done with the wedge of copper strips to show that it provides an accurate method of calibrating diagnostic X-ray equipments so that films of the same subject can be obtained with an identical quality by means of a number of units of different type and of different manufacture. The use of photoelectric exposure timers is being extended to general radiography, and much of the difficulty of assessing the exposure required by different patients is thus eliminated. Improved methods of

¹ Read at a combined meeting of the Section of Public Health, Tuberculosis and Tropical Medicine and the Section of Radiology and Radiotherapy, Australasian Medical Congress (British Medical Association), Sixth Session, Perth, August, 1948.

checking the performance and accuracy of ordinary exposure timers have been developed, and it is to be expected that by the adoption of better methods of servicing, more uniform performance will be obtained.

With the use in recent years of X-ray generators delivering 400 milliamperes or more, which enable radiographs of the chest to be made in much less than one-tenth of a second, it appears that the use of high-speed (and large-grained) intensifying screens is no longer necessary. Experiments have shown that the blurring (or unsharpness of detail) produced by high-speed films eliminates to some extent the advantages of the short exposure time and higher resolving power which should result from the use of rotating anode tubes. It may be that lower-speed, fine-grained screens could now well be used in chest radiography. When higher voltages are used, the overall time of exposure could still be less than that of the conventional radiograph of today.

Much is required in the standardization of X-ray equipment. To some extent, X-ray equipment today has been designed with a view to "selling points" (some of which have very dubious practical value) rather than with a view to the production of radiographs of the greatest technical excellence. When the radiologist has established his standardized radiograph, it will be possible to prescribe for the manufacturer the equipment requirements of the radiologist in a much more definite way than has been possible to date. It can be expected that the lead of the Faculty of Radiologists in Great Britain in setting out in detail the desirable features of X-ray equipment will be followed in this and in other countries. Such specifications will not hamper the individual manufacturer in showing his initiative and resource, and he should welcome the opportunity to design to definite requirements. An appreciable simplification of equipment, with a consequent reduction in capital and maintenance costs, should be possible. The assessment of the performance of a new unit should be made much more easily, and definite tests could be laid down.

It is not to be expected that any movement towards standardization in radiography will not meet some criticism and opposition from radiologists and from manufacturers. Criticism of the constructive type will even be necessary if standardization on the highest level is to be achieved, and I can imagine nothing worse than standardization on a low level of X-ray equipment, or of quality of radiograph, or of skill in interpretation. Opposition may be expected, and all such opposition should be examined on scientific grounds to determine whether it is justified in fact, or whether it springs merely from personal prejudice, or worse still, from sales propaganda. The last-mentioned has frequently played a seriously retarding part in the adoption of newer types of X-ray equipment, and has sprung usually from the fact that some sales organization has found itself temporarily behind a competitor in the supply of a newly developed component. I have seen this opposition to the introduction of the thermionic type of X-ray tube, to valve rectification, to shock-proofing, to rotating anode tubes, to miniature radiographic equipment using a particular size of film, to monitor controlled equipment fitted with safety loading devices, and more recently to the electronic type of impulse timer. Inevitably this opposition vanishes overnight when the salesman is himself able to offer "much improved" components of a similar type. Although this type of sales propaganda is often a retarding influence in the introduction of newer types of X-ray equipment, it may be expected to diminish progressively as the radiologists become more unanimous about their requirements.

To summarize: it can be expected that progress in the standardization of X-ray equipment, particularly with regard to chest radiography, will first require the co-operative efforts of practising radiologists, who must to a great extent discard preconceived ideas and determine anew the qualities of the ideal chest radiograph. The most satisfactory combination of tube voltage, film characteristics, film density and intensity of illumination must be determined. As a result of this work it will be possible to specify new factors for radiographic technique, and it

will then be the responsibility of the manufacturers to design possibly simplified equipment to enable these technical factors to be achieved and reproduced with accuracy under a variety of operating conditions. In all the necessary investigations, the radiologists must have the assistance of well-equipped physical laboratories, staffed with personnel specially trained and keenly interested in the problems of diagnostic radiology. These laboratories will then play a dual role, first in assisting the radiologists in arriving at the requirements of the ideal standard radiograph, and then in assisting the manufacturer by specifying the physical factors to satisfy which equipment should be designed.

Reports of Cases.

CORONARY ANEURYSMS: REPORT OF A CASE.

By K. M. BOWDEN,

Pathology Department, University of Melbourne.

AN aneurysm is a local dilatation of a vessel, and any artery may show localized dilatation. The coronary arteries are no exception, although aneurysm of the coronary vessels is a distinct rarity. It is more of academic than of clinical interest, because there are no distinctive clinical features and at present the condition is not capable of diagnosis before death.



FIGURE I.

Photograph showing the largest aneurysm on the descending branch of the left coronary artery.

Weakening of the media of the arterial wall is the chief cause of aneurysmal dilatation. It may result from lodgement of an infected embolus in the lumen of the vessel with an extension of inflammation into the wall, or from the lodgement of an infected embolus in the wall via its vessels. Syphilis and *periarteritis nodosa* may result in aneurysm formation. Congenital or developmental weakness in the wall is a predisposing factor, especially when there are multiple aneurysms, but trauma is rarely a

factor. Aneurysms of the coronary vessels may be associated with atheroma, as in the present case.

About 30 cases of this condition were reported in the literature until 1939. A survey of these shows that coronary aneurysm is three times more common in males than in females, and that it is more common on the left coronary artery than on the right. In most of the cases reported the aneurysms have been single and situated on the left coronary artery within the first inch of its course; but examples of multiple coronary aneurysms have been seen. Another site is the bifurcation of the main vessels.

Aneurysmal dilatation with tortuosity of the main vessels occurs where the local dilatations are not sharply demarcated from the adjacent portions of the arterial wall. Dissecting aneurysm of a coronary artery has been described.

The aneurysm in half the cases reported has ruptured; rupture has occurred into the pericardium, into the right ventricle, into the right atrium and into the pulmonary artery, and arterio-venous communication has been established between the right coronary artery and the coronary sinus.

These aneurysms vary in size from miliary nodules to the largest recorded in the literature, the sac being six centimetres in diameter.

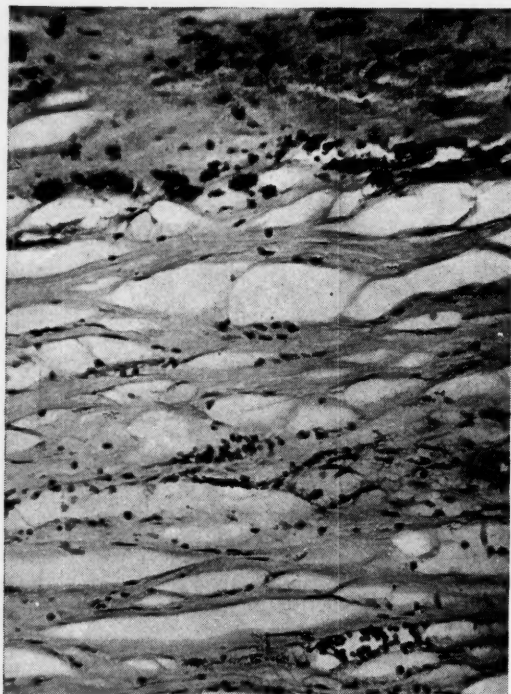


FIGURE II.

Photomicrograph of portion of the wall of the largest aneurysm.

The patient in the first case here presented was a woman, aged seventy-four years, who died in her sleep. One large aneurysm was present on the left coronary artery and two were found on the right main vessel. The pericardial sac was clear. The heart was enlarged, owing mostly to left ventricular hypertrophy and dilatation. The heart weighed 450 grammes. On the anterior descending branch one inch from the origin of the left coronary vessel there was an aneurysm, visible in Figures I and III; it measured one and three-eighths inches in a vertical direction and one inch in width. Atheromatous plaques were visible in the wall, which was reduced to a thin rim

of tissue surrounding the sac. The aneurysm arose just distal to the first branch of the anterior descending artery. This first branch was considerably enlarged and patent. The anterior descending branch and its remaining subdivisions were also enlarged. The aneurysm was filled with laminated clot, which extended down the length of the anterior branch and its subdivisions.

On the right coronary artery, three-quarters of an inch from its origin, there was a second aneurysm half an inch in diameter, and just beyond this there was a third,



FIGURE III.

The largest aneurysm opened up and containing laminated clot.

also half an inch in diameter. The right coronary artery was enlarged and contained numerous atheromatous plaques in its wall. Both these aneurysms were filled with laminated clot, as was the right coronary vessel beyond the third aneurysm described.

The coronary orifices were patent and not reduced in size, but atheroma was present in the aorta around the left coronary orifice.

The ascending aorta was relatively free of atheromatous patches, which were, however, present in the arch of the aorta and distal thereto.

There were no old scars in the heart muscle and no evidence of previous infarction was found.

There was a small area of terminal infarction in the middle of the anterior wall of the left ventricle close to the interventricular septum, which had occurred immediately prior to death.

Examination of microscopic sections of the wall of the large aneurysm showed the usual changes seen in atheromatous vessels. The wall was very thin, the intima was irregularly thickened. There were some atheromatous plaques in the intima projecting into the lumen; some of these plaques were calcified. The media was much thinner than normal. Nearly all the muscle had disappeared. It was replaced by fibrous tissue showing hyaline change. The elastic tissue had largely disappeared. In the adventitia there were some aggregations of small round cells and in addition some plasma cells. There were also a

few small round cells and plasma cells in the media. Some of the small capillaries in the media had ruptured and some small patches of brownish pigment were present.

The primary change in the vessel wall was atheromatous, and the collection of cells in the media and the adventitia could be explained on the basis that they were part of an active atheromatous process—active, not degenerative—or else that they represented a reaction to a degenerative atheromatous process in the vessel wall. There was no microscopic evidence of a primary inflammatory lesion in the arterial wall separate from the atheroma. The microscopic appearance is illustrated in the accompanying photomicrograph (Figure II).

The wall of the coronary artery just beyond the aneurysm showed similar changes, and in the clot filling the lumen there had been an attempt at organization. The



FIGURE IV.

An aneurysm half-way down the interventricular branch, laid open and with the clot removed. The thrombosed artery is visible proximal and distal to the aneurysm.

clot contained capillary spaces and collections of small round cells and endothelial cells.

Dr. A. S. Ferguson, of Auburn, obtained the following history about this patient. Five years prior to her death she had had an attack of what was apparently coronary obstruction. In this attack she complained of a severe tight feeling in the chest. At this time ventricular fibrillation commenced and continued until her death. She was free of any symptoms suggestive of coronary arterial disease until one week before her death, when she again complained of severe precordial pain and tightness in the chest. This precordial pain was present continuously during the week before her death.

A further case occurred in a man, aged sixty-two years, who dropped dead at work while in charge of a party of railway gangers. For twelve months prior to his death he had been treated for "heart attacks", and on a number of occasions had had "fainting attacks" at work. Autopsy

revealed an enlarged heart weighing 24 ounces. The left ventricle was dilated; its wall was thin. There had been previous extensive infarction of the left interventricular wall and of the adjacent anterior portion of the left ventricle. The infarcted muscle was replaced by fibrous tissue. There was a small aneurysmal bulge on the anterior ventricular wall, one inch in diameter, where the previously infarcted wall was reduced to a thin layer of fibrous tissue. The left coronary artery at its origin and in its proximal portion was considerably enlarged in diameter. Half-way down the left interventricular branch there was an aneurysm, one inch in length by three-eighths of an inch in width. It was very thin-walled and was filled with partially organized blood clot. The interventricular vessel beyond the aneurysm was filled with old clot. There were extensive atheromatous changes in the remaining portions of the coronary arteries. Figure IV shows the aneurysm opened and with the clot removed. The microscopic appearance in the wall of the aneurysm was similar to that described in the first case. There were many small round cells in the adventitia and in the intima, as well as a few scattered endothelial cells and fibroblasts. This appearance of cells is often seen in the wall of atheromatous vessels and appears to be part of the atheromatous process. There was no definite resemblance to a syphilitic lesion.

Summary.

Any artery may show aneurysmal dilatation, including the coronary vessels. Two cases of coronary aneurysm, atheromatous in origin, are described and illustrated.

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Reviews.

NEURO-OPHTHALMOLOGY.

"CLINICAL NEURO-OPHTHALMOLOGY", by Frank B. Walsh, is perhaps the most ambitious attempt yet made to cover the field of neuro-ophthalmology.¹ As associate professor of ophthalmology to the Johns Hopkins University, the author has had amongst his colleagues Dandy, Moore and Alan C. Woods. His opportunities for the collection and observation of clinical material have been exceptional—opportunities of which he has availed himself to the fullest extent. Whenever possible, he has added his own case histories and comments to a review of the literature of the disease under discussion. The introductory remarks to the chapter on nystagmus indicate the author's attitude of mind: "A complete review of nystagmus is not attempted here because the mass of literature has become so large and is so replete with hypotheses and diagrams, the present writer freely admits to much of it being beyond his comprehension." Balance and common sense are displayed on every page, and the book, which is a mine of accurate information, will for many years hold pride of place as the encyclopædia of neuro-ophthalmology.

The immense field covered by the author makes the task of the reviewer difficult. Headache, the bane of every oculist, is presented in a particularly attractive manner, and the comparatively minor role of the refractive error is assessed at its true value. The author refuses to believe that there is anything in the theory of anisoeikonia and maintains a discreet silence on the value of orthoptics. Under the heading of "Papilloedema; Optic Neuritis; Optic Atrophy", a long discussion betrays the uneasiness felt by the experienced ophthalmologist when asked to give an opinion on an optic disk. After remarking that "pallor alone is a poor criterion of optic atrophy", he points out that the pallor of primary optic atrophy is due to the disappearance of small blood vessels and that the glial

¹ "Clinical Neuro-Ophthalmology", by Frank B. Walsh, M.D., F.R.C.S. (Edin.); 1947. Baltimore: The Williams and Wilkins Company. Sydney: Angus and Robertson. 10" x 6", pp. 1552, with many illustrations. Price: £6 15s.

tissue still remains. To suggest that the temporal pallor of a normal disk is also due to a local anemia is not anatomically sound, nor is it reasonable to say that some minor degree of optic atrophy must be present with a pale disk even if the vision is normal and no defect demonstrable in the visual field. Arm-chair speculation of this nature may be due to the author's use of the Ferree and Rand perimeter as a routine measure, so that he has overlooked many lesions which would be obvious on the Bjerrum screen. Later on he returns to the question of normal cupping with the remark that "naturally the cupping is influenced by the size of the posterior scleral foramen through which the optic nerve passes". This is the only explanation which allows the ophthalmoscopic observer any useful basis for comparison.

The report of Merz on "Nutritional Amblyopia in Liberated American Prisoners of War of the Japanese" is of particular interest. Here the observer is likely to be misled by his knowledge that the patient has a definite field defect into believing that a pale disk is necessarily atrophic. In this country, where repatriated Australian prisoners of war were examined at the same time as healthy soldiers who had not gone overseas, it was quickly apparent that the ophthalmoscope revealed no evidence of damage to the fibres of the optic nerve or to the central area. The normal soldiers served as a control, and their use demonstrated that very pale disks with a large physiological cup were often accompanied by normal vision and a normal field. On the other hand, it was never possible to demonstrate any pallor of the neuroglial tissue even when a dense scotoma was present. Some subjects with dense scotomata presented disks with no physiological cup and no pallor. Merz, in common with other observers, refers to the absence of the foveal reflex. This sign does not appear to have any value, as it was demonstrated amongst the normal controls as often as amongst the prisoners of war with amblyopia.

Another reference of local interest is to the association of maternal rubella with congenital cataract. The author seems rather precipitate in accepting the dictum of Swan *et alii* that infection with German measles during the first three months of pregnancy should be considered as an indication for therapeutic abortion.

"Clinical Neuro-Ophthalmology" is obviously the product of a wide clinical experience and an extensive knowledge of the literature. No ophthalmologist and no neurologist can afford to be without this book.

EMERGENCY SURGERY.

OWING to binding difficulties the sixth edition of Mr. Hamilton Bailey's "Emergency Surgery" is being produced in five parts.¹ Part I is the subject of this review and once again it is a privilege to discuss this now well-established surgical classic.

The first four chapters are devoted to methods of fluid replacement, stress being laid on correct fluid balance. Brief mention only is made of the parenteral administration of amino acid solutions, owing to the then difficulty of their procurement in Great Britain. More about this will certainly be written in the next edition. Isbister has recently shown that in their absence the level of plasma proteins can be efficiently and quickly raised by plasma infusion.

In the discussion on direct compatibility tests with the use of stored blood (page 32, last paragraph) it is stated that a sample of the stored blood may be taken from the flask with a sterile glass rod after removal of the screw top. To obviate this possible means of contamination, it is better to place a sample of the blood in a little sealed tube at the time of taking and fasten it with wire to the bottle as is done by the Red Cross Bank in Sydney.

In the chapter on anaesthesia, Mr. Bailey rightly decries inhalation anaesthesia. More might be said, however, on the combination of "Pentothal" and the curare preparations now so much in vogue for abdominal anaesthesia. Few anaesthetists will agree that "on no account should nembutal or other barbiturates be ordered when pentothal is used" (page 52). Indeed it is a very common practice, and the "Nembutal" acts as a good indicator to show the tolerance of the patient for the barbiturates. A marked response to a small dose of "Nembutal" will make one careful with the "Pentothal".

¹"Emergency Surgery", by Hamilton Bailey, F.R.C.S. (England), F.A.C.S., F.I.C.S., F.R.S.E.; Part II; Sixth Edition; 1948. Bristol: John Wright and Sons, Limited. London: Simpkin Marshall (1948), Limited. 10" x 6", pp. 188, with many illustrations, some of them coloured. Price: 21s.

It would be fitting in this chapter to stress the importance of an empty stomach in all patients about to undergo an emergency operation under any anaesthetic agent, even local anaesthesia. The passage of a Ryle's tube with withdrawal of the stomach contents will prevent many tragedies due to the inhalation of food down the trachea. When "Pentothal" is used, vomiting may cause a frightening laryngeal spasm. Should "Pentothal" laryngeal spasm occur, curare will overcome it.

The chapter on impending death under anaesthesia is very instructive. The emergency anaesthetic outfit is an excellent idea. It could even be extended to include sterilized instruments to make the incision for cardiac massage. Collapse under anaesthesia often occurs in such operations as tonsillectomies and valuable time may be lost obtaining sterilized (or even unsterilized) instruments for this purpose.

The principles of the treatment of peritonitis are fully discussed. Now that penicillin is freely available it will come much higher up on the list of the bulwarks of conservative treatment given on page 110. The use of streptomycin in tuberculous peritonitis and in general peritonitis will doubtless be included in the next edition. The efficacy of cortin and gas-gangrene antiserum is very problematical. Few surgeons now use sulphanilamide powder as freely as Mr. Bailey does in the peritoneal cavity or the wound, powdered penicillin being used in its stead. Powdered sulphanilamide placed intraperitoneally may be followed by jaundice and later adhesions.

The surgery of acute appendicitis is dealt with thoroughly. It is rarely necessary to eventrate the caecum as shown in Figure 207. Warning of the presence of the branch from the posterior caecal artery forming the "angular anastomosis" at the base of the appendix might be given as it can cause troublesome bleeding if it is not ligated. Fewer and fewer surgeons use carbolic acid to touch the appendiceal stump and many do not insert the purse-string suture in the caecum.

It is pleasing to note that the "lump" in the right iliac fossa associated with the early inflamed appendix is termed a "peri-appendicular phlegmon", the term abscess being reserved for the later stage when pus is actually present.

On page 144 is given a graphic case history of a patient suffering from a pelvic abscess which every young surgeon should read and re-read, so vivid is its portrayal.

Conditions simulating acute appendicitis are described in detail. One feels, however, that conservative treatment of the acute phase of Crohn's disease with a careful follow-up of the patient is important as in many of these acute cases the condition does subside without the necessity of a bowel resection.

It is to be hoped that in the later sections a chapter on post-operative care will be included with special emphasis on the value of bowel rest and the dangers of aperients and enemata which have been continually stressed by Victor Kinsella, of Sydney.

There is no need to recommend this book to those whose fortune it is to be responsible for the care of patients requiring emergency surgery: its fame was established with the first edition. The artists deserve high praise for the illustrations and the publishers for the book itself.

ISOTOPES IN BIOLOGY AND MEDICINE.

"A SYMPOSIUM ON THE USE OF ISOTOPES IN BIOLOGY AND MEDICINE", by numerous contributors, has been published by the University of Wisconsin Press.¹ The book is an excellent collection of essays comprising the major papers contributed at a conference held at Madison in September, 1947. The sponsors do not claim to have produced a textbook and are to be congratulated for their courage in bringing to publication a series of articles on a subject which is still in a process of development and change. Hitherto, readers interested in the radioactive isotopes have depended largely on articles in medical and scientific journals, and few volumes have been available. Successive articles in this book deal authoritatively with various aspects of artificial radioactivity. Commencing with the historical background, the discourse proceeds to detail the methods of detection and measurement of both stable and radioactive isotopes. Problems of metabolism and tracer studies are fully covered. It is interesting to read of the ingenious methods applied to the determination of the in-vivo survival of transfused red blood cells stored under varying conditions

¹"A Symposium on the Use of Isotopes in Biology and Medicine", by various contributors; 1948. Madison: The University of Wisconsin Press. 9" x 5", pp. 448, with illustrations. Price: \$5.00.

(page 336). In physiology and pharmacology concepts current prior to experiments with "tracers" have required revision. For instance, in the not so distant past it was held that few substances apart from the mercurial preparations were absorbed from the intact skin. It has now been shown by means of "tagged" sodium atoms that sodium chloride in an ordinary ointment base is absorbed percutaneously.

The chapters dealing with the medical applications and therapeutic usage of radioactive phosphorus and radioactive iodine are illustrated by graphs and accompanied by statistical results of patients treated. Numerous case histories are recorded in some detail. Good results are claimed in the treatment of *polycythemia vera* in 85% of patients treated. In the chronic leucæmias it is stated that the results are similar to those obtained with deep X-ray therapy. The essayist recorded that in acute leucæmia, Hodgkin's disease and multiple myeloma, treatment with radiophosphorus was ineffective. Another writer considered that radioactive iodine had found a place in the treatment of properly selected cases of hyperthyroidism and in certain rare instances of cancer of the thyroid.

A noteworthy feature of the book is the liberal bibliography at the conclusion of each chapter. An apology is made for an unusually large number of *errata*. Most of these appear to be simple typographical errors and minor changes by authors. The book can be recommended to all those interested in the usage of isotopes.

OPHTHALMOLOGY IN THE WAR YEARS, VOLUME II.

THE second volume of "Ophthalmology in the War Years (1944-June, 1946)" has again been edited by Meyer Wiener with the help of a large staff of contributors who have been drawn from many famous schools of ophthalmology in the United States of America.¹ The table of contents covers thirty-three chapters and a total of 926 pages are expended on this second volume of review of ophthalmic literature during the second world war. The task is now completed and all ex-service ophthalmologists should be grateful for the gratuitous work of Wiener and his co-editors. As we pointed out when reviewing the first volume, this fine effort should not cease, but should be continued into the peace as a permanent contribution to ophthalmic literature. We should again like to congratulate all who contributed to both volumes and recommend their work to Australian ophthalmologists for their perusal. It still appears as if overseas travel is a luxury few Australians will be able to enjoy and that reviews such as this are fortunate in their appearance as a very much needed stop-gap.

A HANDBOOK OF OPTHALMOLOGY.

"A HANDBOOK OF OPTHALMOLOGY", by Neame and Williamson-Noble, "for undergraduate students and general practitioners", is now in its sixth edition.² Books of this nature appearing under the guise of a pocket guide inevitably end up as a small compendium. This is entirely desirable, for surely no intelligent student or practitioner wants only the bare bones in any book of reference.

In the introductory chapters, where the authors have kept in mind the "student starting his study of ophthalmology", the technique of examining the eye and its adnexa is described in detail. For this section alone the book must be highly recommended to the young ophthalmologist. The coming of the electric ophthalmoscope and of the slit lamp has allowed an element of slovenliness to creep into the most exact of the specialties. Their use should be prohibited to the beginner and his attention confined to the reflecting ophthalmoscope and the monocular loupe. Those fortunate enough to make the acquaintance of Neame at "Moorfields" will remember his skill with these simple instruments, and will agree that the extra time and care spent in mastering their use were rewarded by the acquisition of a rapidity

¹"Ophthalmology in the War Years", edited by Meyer Wiener, M.D., and Contributors; Volume II (1944-June, 1946). Chicago: The Year Book Publishers Incorporated. 6½" x 9½", pp. 992, with illustrations. Price: \$16.00.

²"A Handbook of Ophthalmology", by Humphrey Neame, F.R.C.S., and F. A. Williamson-Noble, F.R.C.S.; Sixth Edition; 1948. London: J. and A. Churchill, Limited. 9" x 6", pp. 348, with many illustrations, some of which are coloured. Price: 21s.

and precision in diagnosis which were to prove invaluable in later years.

In this country, where the teaching of ophthalmology is in its infancy, the student ophthalmologist could base his method of clinical examination on no firmer foundation than on Chapters I and II of "Neame and Noble".

TREATMENT BY MANIPULATION.

"TREATMENT BY MANIPULATION" by A. G. Timbrell Fisher has now reached a fifth edition.¹ Since it was first published twenty-three years ago this book has been accepted as a standard work on the subject. The recent edition has been fully revised.

The author approaches the subject from a strictly anatomical point of view and an attempt is always made to correlate pathology with treatment. Each joint is discussed in detail, and the various manipulative procedures are further explained by photographs and diagrams, many of which are new to this edition. The author is at pains to put manipulation in its proper place and to separate it from the cult of osteopathy. Throughout the book he maintains a conservative attitude and, though acquainted with, he is not convinced by many of the recent advances in orthopaedics. For example, he does not regard an intervertebral disk lesion as a common cause of low back pain, and only passing reference is made to Betts's interdigital neuroma as a cause of metatarsalgia. On the other hand no extravagant claims are made for manipulation alone, and the book gives a well balanced account of manipulative methods that are in common use today.

NATURAL CHILDBIRTH.

Most doctors nowadays prescribe pre-natal and post-natal exercises, and usually recommend to the expectant mother a book of instructions; such a book is "A Way to Natural Childbirth" by Helen Heardman, but it is more than a mere set of instructions, for if it is used intelligently it will do much to make childbirth the natural phenomenon it is.² The author is a trained physiotherapist who has herself borne three children, so she at least knows the subject of which she writes. She follows closely the teaching of Grantly Dick Read, especially in regard to the principles of relaxation during the various stages of labour. An interesting chapter headed "The Mothers Have Their Say" presents the candid opinions of mothers on this method of natural childbirth. Throughout, the book is written in simple terms, designed for complete understanding by lay women, and many excellent diagrams enhance the text. All physicians can recommend this book with confidence to future mothers.

PHILOSOPHY AND LITERATURE.

EVEN if the name Gustav E. Mueller did not appear as that of the author the heavy hand of the Teutonic philosopher would be obvious in the serious essay on "Philosophy of Literature".³ The author, who is professor of philosophy in Oklahoma University, selects certain writers from Homer to Dostoevsky (all Russian names, by the way, are given in the German equivalents, even Iwan for our Ivan) and presents these as types of philosophic trends. Whether Thomas Mann's *Lotte in Weimar* is just fit to be included in the same company as the *Iliad*, the *Divine Comedy*, *Hamlet* and *Faust* may be open to doubt. The main thesis of the author is that the great works of world literature survive on account of their philosophical significance. This will by no means be generally conceded and readers of Anglo-Saxon upbringing may pointedly ask just what part metaphysical synthesis plays in the creation of Jack Falstaff and Sairey Gamp. The author is a man of learning; he knows his

¹"Treatment by Manipulation in General and Consulting Practice", by A. G. Timbrell Fisher, M.C., M.B., Ch.B., F.R.C.S. (England); Fifth Edition; 1948. London: H. K. Lewis and Company, Limited. 8½" x 5", pp. 290, with illustrations. Price: 25s.

²"A Way to Natural Childbirth: A Manual for Physiotherapists and Parents-to-be" by Helen Heardman; 1948. Edinburgh: E. and S. Livingstone, Limited. 7" x 4½", pp. 134, with illustrations. Price: 7s. 6d.

³"Philosophy of Literature", by Gustav E. Mueller; 1948. New York: Philosophical Library. 8½" x 5½", pp. 244. Price: \$3.50.

Goethe, his Shakespeare and his Dante and the other half-dozen writers dealt with, but he shows the Teutonic weakness for building up top-heavy structures of dogmatic deduction, verbosely expounded, on very slender foundations. Here, for example, is how he treats the Walpurgis night of Faust: "It is the enjoyment of nature as floating, sensuous, illusory appearance, as crippled, sterile or superabundant vitality as external good 'Where we see with awe profound Mammon lighting up the ground'. It is also history as a romantic, picturesque, superficial and fragmentary theater; at the court of Satan-history is mummified dust, subjective falsification, dead tradition, arbitrary cleverness and futile retrospection." The style is turgid in the extreme and sometimes the meaning must completely escape the comprehension of the ordinary reader. For example: "In the center of Dante's hell the frozen devil, sticks in the center of the Daemons stands Stawrogin, a Dorian Grey-like [sic] handsome mask, around him the gruesome dance of a witches' sabbath, whirling atoms, whose uniting purpose is negation and destruction, machines without leaders racing in circles, driven by competitive envy."

That the author is capable of attractive writing and luminous exposition is shown in his short sketch of Hermann Hesse which is indeed admirably done. If this professor of philosophy would give us some biographical vignettes and succinct critical comments on the plan of his Hermann Hesse we should be grateful.

A POCKET MEDICINE.

It is fashionable at present to produce medical text-books as well as food on a concentrated, digested scale, and such a book is "A Pocket Medicine", by G. E. Beaumont, the second edition of which now appears.* However, when such a book is compared with the author's larger work, "Essentials of Medicine", it is realized that even though the subject matter is greatly condensed, the book is far less palatable. In the preface the author states that "this small book has been written for the use of medical students when working in hospital, and while waiting and travelling"; while, because of its handy size, it will certainly prove useful in this respect, students might be better advised to read a good mystery while travelling, and then to concentrate on an unprinted text-book for their studies. "Crammers" may find the book a help, but the three lines devoted to achondroplasia will not teach them enough to answer the simplest query on that subject; nor do the six lines upon carcinoma of the prostate present that topic in an adequate nutshell. However, as the book has run through two editions and two reprints since it first appeared in 1942, it certainly must have a ready sale, and perhaps this proves that students prefer their reading without much "bulk", even though such reading may not produce vigorous mental peristalsis.

Notes on Books, Current Journals and New Appliances.

AN ENCYCLOPÆDIA OF MEDICAL SOURCES.

In the introduction to his "Encyclopedia of Medical Sources", Emerson Crosby Kelly describes how in a book which he assisted to write McBurney's point was put in the wrong place.† A check revealed that many other authors have erred similarly through failure to consult McBurney's original paper. This and other like experiences induced Kelly to start keeping a list of references to medical eponyms and original work. He has now had his list published in the form of an encyclopedia which certainly indicates great diligence and wide reading on the part of the compiler. The arrangement of the book is simple. The main text lists alphabetically the names of men who have written something of a medical note with a brief statement as to who they are or were and the dates of their birth and death (where appropriate). Then there is reference to any

* "A Pocket Medicine", by G. E. Beaumont, M.A., D.M. (Oxon.), F.R.C.P., D.P.H. (London); Second Edition; 1948. London: J. and A. Churchill, Limited. 7½" x 4½", pp. 218. Price: 9s.

† "Encyclopedia of Medical Sources", by Emerson Crosby Kelly, M.D., F.A.C.S.; 1948. Baltimore: The Williams and Wilkins Company. Sydney: Angus and Robertson, Limited. 9" x 5½", pp. 484. Price: 56s.

special procedure, disease, instrument or other important matter with which the individual's name may be associated with the title and full reference details of the paper or book in which it is described. Cross references are given to associated persons. In addition there is an index of subject headings in which reference is given to the appropriate eponyms. It is stated that the list includes over 5000 names and 15,000 references and that 95% of the papers listed have been consulted in the original. In a task of this size it is not altogether surprising that some errors have occurred, though in this type of work they usually come to light only as the book is explored during constant usage. The few that we have noted are the spelling of de le Boë as de La Boë on page 395, of de Sauvages as de Sauvagos on page 362, and Schüller as Schiller on page 181. Without seeking to be parochial we should like to see Sir Howard Florey acknowledged as being an Australian, and suggest that the author consider the inclusion in subsequent editions of N. M. Gregg (congenital abnormalities associated with maternal rubella during pregnancy), E. H. Derrick (Q fever) and H. Swift (pink disease). The name of F. M. Burnet already appears, but reference to *Rickettsia burneti* might be added. These are intended as suggestions and constructive comment rather than as criticisms, for Kelly has produced an interesting and useful volume from which we should like to see even minor flaws removed. It should be appreciated not only by students of medical history, but by all who are interested in basic medical documents.

Books Received.

[The mention of a book in this column does not imply that no review will appear in a subsequent issue.]

"Mycoses and Practical Mycology: A Handbook for Students and Practitioners", by N. Gohar, M.R.C.S. (England), L.R.C.P. (London), with a foreword by Sir Philip Manson-Bahr, C.M.G., D.S.O., M.A., M.D., D.T.M. and H. (Cantab.), F.R.C.P. (London); 1948. London: Baillière, Tindall and Cox. 8½" x 5½", pp. 252, with 134 illustrations. Price: 25s.

Written to supply the dermatologist and the general practitioner as well as the student of tropical medicine with a concise clinical guide to mycotic affections.

"Gadd's Synopsis of the British Pharmacopœia, 1948, and of the Law of Poisons and Dangerous Drugs of Great Britain, Northern Ireland and Eire", by H. Wipell Gadd; Fifteenth Edition; 1948. 4½" x 2½", pp. 262. Price: 6s.

A summary of the Pharmacopœia and also of the special laws in Britain and Eire governing the use of drugs which are specially lethal or which may lead to addiction. Intended for practitioners and students.

"Bailey's Text-Book of Histology", revised by Philip E. Smith, Ph.D., and Wilfred M. Copenhaver, Ph.D.; Twelfth Edition; 1948. Baltimore: The Williams and Wilkins Company. Sydney: Angus and Robertson, Limited. 9" x 6", pp. 812, with 455 illustrations, many of them coloured. Price: 52s. 6d.

A book primarily for the use of students of medicine and dentistry beginning their study of histology.

"The Principles and Practice of Rectal Surgery", by William B. Gabriel, M.S. (London), F.R.C.S. (England); Fourth Edition; 1948. London: H. K. Lewis and Company, Limited. 9½" x 5", pp. 524, with 278 illustrations. Price: 45s.

A revised edition of this standard work with a new chapter on "Anal Incontinence".

"Practical Public Health Problems", by Sir William Savage, B.Sc., M.D.; Second Edition; 1949. London: J. and A. Churchill, Limited. 8½" x 5", pp. 212, with three illustrations. Price: 14s.

An account for medical officers of health and sanitary inspectors of practical problems such as control of water supplies, sewage disposal, infectious disease outbreaks, food control and housing inspection.

"Bronchiogenic Carcinoma and Adenoma: With a Chapter on Mediastinal Tumors", by B. M. Fried, M.D.; 1948. Baltimore: The Williams and Wilkins Company. Sydney: Angus and Robertson. 9" x 6", pp. 324, with 118 illustrations. Price: 45s. 6d.

"The outcome of extensive studies based on large clinical and post mortem material."

"The Development of Modern Medicine: An Interpretation of the Social and Scientific Factors Involved", by Richard Harrison Shryock; 1948. London: Victor Gollancz, Limited. 8½" x 5½", pp. 388. Price: 21s.

An attempt to portray certain major aspects of medical development against the background of intellectual and social history in general.

The Medical Journal of Australia

SATURDAY, FEBRUARY 12, 1949.

All articles submitted for publication in this journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given without abbreviation: initials of author, surname of author, full title of article, name of journal, volume, full date (month, day and year), number of the first page of the article. If a reference is made to an abstract of a paper, the name of the original journal, together with that of the journal in which the abstract has appeared, should be given with full date in each instance.

Authors who are not accustomed to preparing drawings or photographic prints for reproduction are invited to seek the advice of the Editor.

PSYCHOSOMATIC MEDICINE: A SCHISM OR ANOTHER SPECIALTY?

TOWARDS the latter end of 1944, in the course of a discussion of psychosomatic surgery it was stated in these pages that during recent years increasing emphasis had been laid on the mental factor in disease—on the effect which an infection might have on the patient's psyche and on the way in which the patient's mental make-up might influence the manifestations of disease. This special study was known as psychosomatic medicine. Then followed the following words: "Though strictly speaking the term is not necessary, since the study of disease in an individual should always include the whole man, mind as well as body, its use may be encouraged in the hope that the whole man will always be covered by the investigation." This implies that the whole of medicine is psychosomatic. While this is almost always true, it will be freely admitted that some ailments have a larger mental factor than others. The mental component may have an aetiological bearing; it may be one of the clinical manifestations. When due attention is paid to both the psyche and the soma, there is no doubt that understanding is likely to be complete and treatment successful. There is a great deal of truth in the saying that the physician must become more and more of a psychiatrist, and the psychiatrist more and more of a general physician. Unfortunately there is a tendency among those who try to extend their range of vision and investigation to speak of their work as if it was a narrow specialty and to imply that the number of persons qualified to practise it is small. It is possible that in this way the attainment of the very objects which these psyche *plus* soma enthusiasts would claim—understanding of disease and efficiency in its treatment—will be hindered.

This subject has been brought to notice by what is described as a preliminary report from H. S. Ripley, Stewart Wolf and H. G. Wolff.¹ Over a period of two

years they have treated 889 patients "with bodily disturbances and with emotional reactions occurring as part of the human organism's response to adverse life situations". Of these 690 were followed up for more than a year. The patients ranged in age from five to sixty-nine years; 60% were female and 40% male. They suffered chiefly from bronchial asthma, hypertension, vasomotor rhinitis, migraine, urticaria, hypoglycæmia, dermatitis, peptic ulcer, mucous colitis, ulcerative colitis, and phenomena of muscle tension. It is important to note the methods used in the clinical investigations of these patients. In addition to the usual taking of a medical history and examination with the use of appropriate laboratory tests, a "personality study" was done. Special note was made of the family and cultural background. The state of the patient's health was correlated with events, overt activities, attitudes and emotional responses. The objective, we are told, was to understand the motivations and mechanisms of disturbed function. This examination is complete and should give to the investigating physician a thorough understanding of his patient's make-up and an insight into the nature of his illness. But the whole point is that the investigation described is just what would be expected of any wise physician who was studying a patient's condition. But let us look at the treatment—it is high sounding enough to be worthy of the most specialized specialty: "Treatment was aimed at altering the disordered pattern, so that the patient might achieve more adequate utilization of his capacities toward a greater satisfaction, and a more salutary integration. In so far as was possible, physiologic changes, qualitative and quantitative, were correlated with the emotional reactions and behavior pattern of the patient under varying life situations. Then an attempt was usually made to explain to the patient what had been happening to him in order that perplexity might be replaced by a grasp of the dynamic mechanisms at work. The past experiences and reactions were integrated with the present in order to increase insight into his life adaptation." This means that the physician, after making his study of the patient's condition, tried to secure the latter's understanding, confidence and cooperation and that this was part of the treatment. This, again, is what would be expected at the hands of any erudite physician of today. The results achieved by Ripley and his collaborators were encouraging. Of the 690 patients, 113 were considered by their physicians to be "symptomatically and basically improved"; 234 were considered to be "only symptomatically improved" and 343 "unimproved". Of the 343 patients in the unimproved category, 191 attended the clinic for less than a month and of these 82 received no treatment. If those who received no treatment are excluded, 19% were "basically improved", 38% were "symptomatically improved" and 43% were "unimproved". The tag "symptomatic improvement" was applied to those patients who had a "definite and sustained diminution in signs and symptoms over a period of at least a year". "Basic improvement" was the tag applied to symptomatically improved persons who had encountered "a major threat in their life situations" and had shown a "reorientation in outlook by meeting it in a more constructive way and without symptoms". This statement would make it appear that the patients in question were threatened more by an affection of the psyche than of the soma. Be that as it may, it is

¹The Journal of the American Medical Association, November 27, 1948.

essential to consider the value of the various therapeutic procedures that were used. At the risk of being accused of going into too much detail, we must set out the chief procedures and the number of cases in which they were used as follows.

Reassurance and emotional support	309
Free expression of conflicts and feelings	304
Advice regarding attitudes, habits and activities	173
Explanation of psychophysiological processes	140
Symptomatic drug therapy	123
Intravenous use of "Sodium Amytal"	112
Ruling out neoplastic and infectious disease	112
Dealing with other members of the family	101
Development of insight	99
Analysis of emotional development	91
Attempts to modify situations	71
Dream analysis	52
Help from Social Service Department	39

Once more we are confronted with a statement which could be used to indicate the activities of any skilled physician. Perhaps the analysis of emotional development and the dream analysis in their full and most technical flowering might be left to a psychiatrist, but of that more later.

The chief thing about this work is that it has been carried out at a "psychosomatic clinic". This is an indication of what we call a schism or at least a possible schism in the ranks of those who practise clinical medicine—it is more than a division of specialties. We cannot help thinking that such a strict segregation of patients into a psychosomatic clinic is not in the best interests either of the patients or of the art and science of medicine. It is a gratuitous segregation, for after all the illness of practically every patient has a psychosomatic basis. One physician with a broad outlook on the practice of medicine and with many years of experience, when asked what he thought of the establishment of a psychosomatic clinic, said that it sounded as though it was intended to deal with every type of patient. From the patient's point of view we can imagine that harm would sometimes be caused to one of the more suggestible type because he was being sent to a special clinic with a special name. We can also see that over-emphasis of the psychosomatic tag will be likely to create a wrong impression in the minds of general practitioners and of some physicians—that investigation of psyche and soma and of their bearing on one another is the province of a specialist. We know perfectly well that every practitioner who does a good job of work for his patient (if such an everyday term can be so applied) does in fact practise psychosomatic medicine. It is a pity that the advocates of psychosomatic medicine have to dress up their ideas in superior and excessive language, as, for example, that used in the reference to more adequate utilization of capacities toward a greater satisfaction and a more salutary integration. It lays them open to the accusation that they are trying to make it all seem difficult and important. The real objective of all references to psychosomatic medicine should be a wider understanding by every practitioner of what the term means. He will then try to cover the whole man, the psyche and the soma, in his diagnosis and treatment. He will occasionally have to ask for the help of a psychiatrist; in this way he will help his patient and enrich his own mind. In the language of Ripley and his two collaborators he may achieve "greater satisfaction and a more salutary integration".

Current Comment.

GASTRIC BIOPSY.

AN ingenious method of investigating the state of the gastric mucosa has been recently devised in Melbourne. It is a flexible gastric biopsy tube, described by I. J. Wood, R. K. Doig, R. Motteram and A. Hughes,¹ with which 55 gastric biopsy specimens have already been obtained from patients with various conditions involving the gastric mucosa, as well as from normal controls. The instrument consists in essence of a flexible tube with, on the end that is introduced into the stomach, a stainless steel cylinder with a rounded, removable end-cap. Inside the cylinder is a knife which is controlled by a wire passing down the flexible tube; it is shaped and adjusted to pass down against a hole in the lateral wall of the cylinder. The tube is passed into the stomach under local anaesthesia, negative pressure is applied inside the cylinder so that a knuckle of mucosa is sucked in through the hole and the knife is pressed into position, so cutting off the knuckle and leaving it inside the cylinder. A detailed technique has been worked out but need not be described here. Satisfactory biopsy specimens have been obtained in most cases, often including *muscularis mucosae*. The procedure does not distress the patient and is practically free from complications. Subsequent examination by means of the gastroscope or at operation indicates that minimal trauma is inflicted and the biopsy site heals rapidly. Two main uses are suggested by Wood and his colleagues for the procedure. Firstly, it may establish a histological diagnosis when there is a diffuse lesion of the stomach; it does not help in the differential diagnosis of a localized lesion, such as ulcer or carcinoma, as the method lacks any "siting". Secondly, it will, they consider, be an adjunct to clinical and pathological study in many diseases in which the gastric lesion is not necessarily the chief feature. In this field the procedure has a number of advantages over previous means of obtaining specimens for study. In necropsy specimens the histological picture may be affected by the cause of death; operation specimens are usually from patients with ulcer or carcinoma; in both cases no serial observations are possible. The gastric biopsy tube will provide serial specimens of gastric mucosa from the living subject in any condition that it may be wished to investigate. This role of investigation of the changes in different disease conditions rather than that of diagnosis of an individual patient's condition seems to be the more promising with the present instrument.

INFANTS AND DIPHTHERIA IMMUNIZATION.

It is generally accepted that most infants in early life enjoy passive immunity to diphtheria. In the last edition of "Osler" the proportion of infants immune at birth is given as 85%. The concurrent assumptions are that most adults are immune to diphtheria and that passive immunity is derived from the mother by the infant *in utero*, disappearing in from the sixth to the ninth month of life. The fact that immunity may be acquired by the infant from the mother appears to be well established, but some recently published work rather upsets the common impression as to how much immunity actually exists. Bo Vahlquist,² in an investigation with antitoxin titrations on Swedish children, found that only 16% of children under the age of three months had antitoxin in measurable amounts (0.0005 unit per millilitre of serum or more), and he quotes the results of investigators in many countries to support his contention that "in many parts of the world most infants completely lack antitoxic immunity against diphtheria". This is associated with an apparent decrease in the immunity of the adult population, though how much this decrease is real and how much due to

¹ *The Lancet*, January 1, 1949.

² *The Lancet*, January 1, 1949.

fallacious results obtained by early investigators (for example, from unwitting selection) is not clear. The important consideration is the unappreciated degree of susceptibility amongst infants. Vahlquist points out that the risk to them of contracting diphtheria is probably low, because of relatively less exposure and possibly a better "resistance" in their mucosa; but, if they do contract the disease, the course is often malignant and the mortality high. In view of this risk he has been investigating both the passive and the active immunization of infants. After active immunization of mothers during pregnancy the antitoxin level in the newborn was usually above 0.02 unit per millilitre of serum, but fell rather rapidly. The results of active immunization of the children show that, despite accepted ideas to the contrary, newborn infants can be immunized. The interval between the injection and the appearance of antibodies is often long in this age group, but the antitoxin level subsequently attained does not differ from that of older children. It was found, however, that a level of passively acquired antibodies of or above 0.1 unit per millilitre of serum apparently inhibited entirely the effect of injecting toxoid in the dosage used; when the level was below 0.02 unit per millilitre there did not appear to be any inhibition. Vahlquist considers that in countries where the natural immunity against diphtheria is low, vaccination should preferably be carried out in the first three months of life and booster doses be given at the age of one year and on the child's entering school. In countries with more or less widespread natural immunity, passively transferred antibodies may interfere seriously with the effect of vaccination early in life, and vaccination on a large scale should not be attempted in infants under the age of six months. Passive immunization through active immunization of the mother during pregnancy should be used only when there is a serious risk of epidemics of diphtheria involving the infant during the first months of life. With what enthusiasm these recommendations will be received by public health authorities remains to be seen, but Vahlquist has certainly raised some new questions. Before any hasty attempt is made to accept or reject the relevance of his suggestions in Australia it would be interesting to know the degree of immunity existing in a reliable cross-section of Australian mothers and newborn infants.

VITAMIN B₁₂.

VITAMIN B₁₂ is a crystalline substance recently isolated from liver extracts and found to produce hæmatological remissions in pernicious anæmia. It has been available only in small amounts in the United States of America and its clinical use is still in the investigation stage, but preliminary reports suggest that it is a potent and important substance. An account of its use by four Harvard investigators, L. Berk, D. Denny-Brown, M. Finland and W. B. Castle,¹ is of great interest, particularly because of the associated use of folic acid. The patient, a mulatto woman in her early forties, had been treated at the Boston City Hospital for some six years for pernicious anæmia. She had developed an allergic sensitivity in turn to pork-liver and beef-liver extracts, so that in 1946 treatment was commenced with folic acid, typical clinical and hæmatological responses occurring. Up to that stage no neurological changes had been demonstrable. The administration, at first intramuscular and then oral, of folic acid was continued rather irregularly till her readmission to hospital in May, 1946. She then had a severe degree of anæmia and symptoms and signs of acute combined disease of the spinal cord. Folic acid therapy was discontinued, a diet free of fish, meat and eggs was prescribed, and no antianæmic treatment was given for four days. The neurological lesion continued to progress. A test of sensitivity to pork-liver extract produced a severe local and a serious systemic reaction. On the fifth day in hospital treatment was commenced with injections of vitamin B₁₂, after tests had demonstrated the absence of sensitivity to the substance (an important finding in

itself). There was an almost immediate favourable response in both the hæmatological and the neurological conditions, that in the latter being especially remarkable. The therapy was discontinued for seven days from the ninth day of treatment, because of supply difficulties; her neurological condition began to deteriorate on the thirteenth day, but again began to improve five days after treatment was reinstituted. Progress from then on was steady and satisfactory in every way. Thus this crystalline liver derivative appears to be able to affect favourably both the hæmatological and the neurological conditions associated with pernicious anæmia, though, as the report points out, there is nothing to indicate that it is more effective than liver extract. The question is discussed whether the neurological condition (which was evidently associated with a lesion as yet in great part reversible) may not have been due to the folic acid therapy, as the reports of other investigators have suggested; the improvement may then have been the result of cessation of this therapy. Against such an explanation, it is argued, is the progression of the neurological lesion during the first four days that the patient was under observation and the rapid and extensive improvement following the institution of vitamin B₁₂ therapy on the fifth day; especially significant is the slight setback during the interruption of the vitamin B₁₂ therapy with further recovery after its resumption. It seems that another major advance has been made in the analysis of the action of liver extract.

METHADON ADDICTION.

IN a discussion on methadon in these columns on January 8, 1949, reference was made to the findings that only in some instances was a moderate degree of tolerance developed and that there was no evidence of addiction from a limited experience of the drug. Toxil had reported the absence of withdrawal symptoms when methadon was used to replace other narcotics of addiction. It was hoped that methadon would prove to be an analgesic that would help to solve the problem of addiction, though the approach to any narcotic is naturally one of caution and in New South Wales, at least, methadon (including its proprietary forms, such as "Amidone" and "Dolophine") has been declared a dangerous drug, as it has been in the United States. Now further information, with which every practitioner should be acquainted, has come forward in a letter² by H. J. Anslinger, Commissioner of Narcotics in Washington, in which he states that there is evidence of increasing use of methadon by drug addicts to gratify addiction. Some of these addicts have stated that methadon has the same effects on them as morphine or heroin with two exceptions: firstly, the administration of methadon is not accompanied by what they describe as the "tingling sensation" experienced on the hypodermic injection of heroin or morphine, and secondly, the withdrawal symptoms experienced on the removal of methadon are not as severe as those associated with heroin or morphine. However, the methadon withdrawal symptoms are quite definite and the general over-all effect of methadon satisfies the craving of the morphine and heroin addict with the same disastrous results. The most significant point in Anslinger's letter is the fact that narcotic addicts have taken to asking doctors for methadon (or one of its proprietary forms) instead of asking for morphine. They know that a request for morphine following the recital of appropriate fictitious symptoms arouses the suspicions of the doctor. A request for methadon (most commonly in the form of "Dolophine") is, on the other hand, nearly always successful, especially if the name of the drug is written on a slip of paper and produced innocently as someone else's recommendation, a desire being expressed to avoid habit-forming drugs. Discussion with doctors on the part of officers of the Narcotics Bureau revealed a general impression that methadon was not habit-forming and a relative absence of caution in its prescription. It appears that such an attitude is not justified and that methadon is a drug of addiction.

¹The New England Journal of Medicine, August 26, 1948.

²The Journal of the American Medical Association, October 23, 1948, page 609.

Abstracts from Medical Literature.

MEDICINE.

Anæsthesia and Artificial Respiration in Status Asthmaticus.

M. F. REISER AND E. B. FERRIS, JUNIOR (*Annals of Internal Medicine*, July, 1948), have successfully treated three patients in *status asthmaticus*, very ill and unresponsive to every form of treatment, by administering general anæsthesia and placing them in Drinker's automatic respirator. The authors emphasize the fact that such patients would attempt to fight the machine and be made worse unless their level of consciousness was sufficiently depressed to permit passive acceptance of the mechanical aid; they emphasize also that the manoeuvre is not suggested as a substitute for orthodox treatment, but only as an adjunct to it in refractory cases.

Innervation of the Heart.

E. M. CHAPMAN, D. KINSEY, W. P. CHAPMAN AND R. H. SMITHWICK (*The Journal of the American Medical Association*, June 12, 1948) record some observations on the heart rate after thoracic sympathectomy. Twenty patients who had been operated upon for various reasons—hypertension, Raynaud's syndrome, tachycardia and *angina pectoris*—were included in the review. The operations had consisted of removal of the thoracic sympathetic ganglia from the second to the fifth dorsal segment on the left side, and later on the right side, or other similar operations on the sympathetic nervous system. In several cases a slowing of the pulse rate was noted, in others relief of *angina pectoris* and headaches. Some fall in blood pressure was noted in yet other cases and in two cases the cardiograph was said to return to normal after operation. Beneficial results were not recorded in all instances.

Psychosomatic Considerations in Relation to Peptic Ulcer.

MANUEL D. ZANE (*Psychosomatic Medicine*, November-December, 1947) discusses psychosomatic considerations in relation to peptic ulcer. He states that, in the usual case of chronic peptic ulcer, there is an underlying conflict in which the individual feels compelled to function in a certain manner despite anticipation of failure. The peptic-ulcer conflict situation involves both fear and resentment, each of which has an opposing effect on the stomach and duodenum. When fear and resentment are experienced simultaneously, the reactions in the stomach are dissociated, this often resulting in increased amounts of acid, motility, and vascularity with decreased amounts of mucin. It is postulated that, during such dissociations, other protective substances and mechanisms are likewise deficient in the presence of increased acid and pepsin. Such circumstances are highly conducive to the development of ulceration. The ulcer diathesis resides in the basic character structure which readily thrusts the patient into the peptic-ulcer type of conflict situation; if the situation is of short duration the symptoms

will be brief, but if it is sustained they will be prolonged. Chronic indolent ulcers heal as rapidly as acute ulcers when the conflict situation is removed. Variations of gastroscopic findings are best integrated by the psychosomatic concept which assumes both that the emotions affect the colon and appearances of the stomach and that changing emotions are accompanied by prompt changes in the appearance of the stomach. Variations of gastric juice and acid levels during the day and night are explained by the changing emotions experienced. Seasonal recurrence, frequent association of symptoms with infections, and frequency of recurrence are all related to the character structure of the patient. The emotional reaction of the patient is held to be of greater significance than the particular diet or drugs utilized in treatment. The best prognosis exists for patients with the longest intervals between attacks, implying adequate adjustment during the intervals. Patients with pyloro-duodenal irritability may develop demonstrable ulceration in later years if the conflict situation becomes sufficiently intense and sustained. The patient's concern with his diet and pain may in turn result in tension which gives rise to more pain. Peptic ulcer is a psychosomatic disease, and with such a concept a better understanding of the many confusing manifestations of the condition and a more flexible and effective approach to treatment are available.

Adrenal Insufficiency.

G. W. THORN, P. A. FORSHAM, F. PRUNTY AND A. G. HILLS (*The Journal of the American Medical Association*, July 17, 1948) describe a test for adrenal cortical insufficiency. If 25 milligrammes of purified pituitary adrenocorticotrophic hormone are administered to normal subjects there is a fall in the number of circulating eosinophile cells, and an increase in excretion of uric acid within four hours of the intramuscular injection of the hormone. Patients with Addison's disease failed to show these changes. The fall in the number of eosinophile cells in normal subjects is 50% or more below the level before the test is made, and the uric acid-creatinine ratio increases by more than 50%. If the eosinophile cell response fails to occur a complete absence of adrenal cortex reserve may be assumed. The urine before and after the injection (for three hours after) is collected, and the uric acid-creatinine ratio estimated. This shows a definite rise with normal subjects, but none in the presence of Addison's disease.

Incontinence of Urine in the Aged.

T. S. WILSON (*The Lancet*, September 4, 1948) has studied urinary incontinence in the aged by means of cystometric experiments. He states that the main cause of the increased frequency and precipitancy of urination, which are the common urinary dysfunctions in the aged and are often accompanied by incontinence, is overactivity of the neuro-muscular mechanism of the bladder. Sphincteric weakness is important in only a small minority of cases. Overactivity of the bladder mechanism results from diminution of cortical control and (less commonly) from local irritative conditions of the bladder and its outlet. Impaired cortical control may be due to structural

changes within the nervous system and to functional loss of inhibitory power. An impaired mental state is a contributory factor, as also is the confinement of the elderly patient to bed. The condition of some patients may be improved by gradual distension of the bladder with fluid and reeducation in the voluntary inhibition of urination. It is stated that the efficiency of the neuro-muscular mechanism is doubly important when there is prostatic enlargement; in such patients routine investigation of the prostatic syndrome should include cystometry, so that the bladder function may be assessed and if possible improved.

Water Intoxication.

ROBERT COHN, LAWRENCE C. KOLB AND DONALD W. MULDER (*The Journal of Nervous and Mental Disease*, November, 1947) have produced water intoxication by a pitressin hydration test technique and have made electroencephalograph recordings, commencing ten hours after the initial injection. The 23 patients were potential epileptics. Five had seizures during the investigation. It is concluded that the pitressin hydration test has little value. The diagnosis of epilepsy was only once made on the basis of a convulsion observed during the course of the test. In the case of all other patients the diagnosis was established from the history, clinical study and observation. In certain epileptics a positive water balance apparently disturbs already poorly functioning neurons, as determined by the electroencephalographic low frequency activity, and thereby acts as the detonating mechanism for the convulsive discharge.

Aluechæmic Leuchæmia.

BARBARA S. LIPTON AND PAUL C. BUCY (*The Journal of Nervous and Mental Disease*, May, 1948) describe a case in which the only clinical evidence of leuchæmia was meningeal irritation. A stiff neck, a demonstrable Kernig sign, fever and stupor suggested the diagnosis of leptomeningitis. The authors confirm the statement of Schwab and Weiss that neurological signs may often be the only clue in the diagnosis of leuchæmic processes.

Intracranial Calcification.

J. D. CAMP (*The Journal of the American Medical Association*, July 17, 1948) discusses pathological, non-neoplastic, intracranial calcification. X-ray examination reveals calcification in the internal carotid artery in about 1.8% of all X-ray films of the skull. It has been suggested that such calcification gives rise to visual defects and optic atrophy as a result of pressure. Others state that actual disease of the ophthalmic artery would more readily explain such symptoms. Aneurysm of the internal carotid and related vessels may be revealed by evidence of calcification in the aneurysm. Unilateral exophthalmos and oculomotor palsies and involvement of other ocular nerves are significant signs. Angiomatous malformations on the surface of the cerebral hemisphere may undergo calcification, and subdural hematomata are sometimes revealed in this way. Calcification occurs in tuberculomata and also after encephalitis. Cysticercus and trichinosis are associated with calcification in the brain in tropical areas. Degenerative brain lesions in children may calcify. In tuberous

sclerosis multiple small areas of calcification may be noted in the *cortex cerebri* or symmetrically in the basal ganglia. The latter symmetrical basal ganglion calcification has also been reported in cases of parathyroid insufficiency and tetany. The type and distribution of calcification in the brain are often characteristic and diagnostic.

Essential Hypertension.

A. M. FISHBERG (*The Journal of the American Medical Association*, June 19, 1948) describes the result of sympathectomy for essential hypertension in 119 patients. Operation was not performed when there was a doubt whether the hypertension was due to glomerulonephritis or to pyelonephritis. One hundred and nine patients underwent Smithwick's thoraco-lumbar sympathectomy, eight had Peet's supra-diaphragmatic operation and two Adson's infradiaphragmatic sympathectomy. Many patients had severe headaches; some had papilloedema and retinal hemorrhages or exudates, and some had congestive heart failure which had been relieved by treatment. No patient was operated upon whose diastolic blood pressure did not exceed 110 millimetres of mercury. The results showed some lowering of blood pressure in nearly all cases, mainly for some months after operation. Worthwhile symptomatic improvement apart from a fall in blood pressure was noted in 59% of cases. Retinal lesions cleared up in several cases. The author is in doubt whether the operation prolongs life, but on the whole he thinks it does. He mentions certain disadvantages, such as a 3-5% mortality at operation, much discomfort or suffering which may be complicated by pleurisy and infection, hypotension, neuritic pains in the back, unfitness for work for at least three months, sterility, and aggravation of arteriosclerotic conditions. None of the patients was cured.

Aerosporin.

M. PARAF (*La presse médicale*, March 4, 1948) reports on a new antibiotic, aerosporin. Derived from the *Bacillus aerosporus*, it is active against Gram-negative organisms, especially the bacillus of pertussis and the typhoid-paratyphoid-coli group. It is more active than streptomycin against *Bacillus coli*, *Bacillus typhosus*, *Bacillus pyocyaneus* and the organisms of dysentery, cholera and plague. One-tenth of the dose of streptomycin inhibits these organisms. Influenza and whooping-cough are also influenced by smaller doses of aerosporin. Unfortunately aerosporin has toxic effects on renal and nervous tissues, but only in large doses.

Cervico-Brachial Pain.

C. E. HAGGART (*The Journal of the American Medical Association*, June 5, 1948) discusses the value of conservative management of cervico-brachial pain. He omits from consideration subacromial bursitis and tears in the musculo-tendinous cuff, that is, conditions which do not cause interference with the neuro-vascular structures. Various causes of pain are considered, such as cervical rib, the scalenus syndrome, pain from hyperabduction of the arm in treatment of injuries, the costo-clavicular syndrome, and intervertebral disk syndromes. Cervico-dorsal scoliosis, asymmetry and varia-

tions in the thoracic outlet, postural defects of the shoulder girdle and causalgia or sympathetic dystrophy, are all considered. Various conservative methods of treatment are mentioned, especially rest in bed and adjustment of posture of head, neck and arm. Moist and dry heat and gentle massage are recommended, especially for arthritis of the cervical part of the spine. With disk lesions intermittent traction of the head has given relief. Pillows under each shoulder while the patient was at rest in bed often gave relief. Posture during sleep and graduated exercises were always practised. Posture during work, traction during "Pentothal" anaesthesia, vitamin B complex and aspirin are all useful in certain cases. The author states that these conservative measures were of the greatest benefit to many patients and deprecates operation until all such measures have had a thorough trial.

"Caronamide" and the Excretion of Penicillin.

R. B. HUNTER *et alii* (*The Lancet*, October 16, 1948) have confirmed American reports that the drug 4-carboxyphenylmethanesulphanilide ("Caronamide"), when given by mouth, will delay the excretion of penicillin by the renal tubules and raise the level of penicillin in the blood. There is no evidence of damage to the kidney and the inhibition of the tubules is readily reversed by stopping the administration of the drug. However, the authors point out that any drug which interferes with the function of the renal tubules should be used with caution; this should be especially borne in mind with "Caronamide", and it should be used only in cases in which a high level of penicillin in the blood is essential, because it causes a reducing substance, apparently a pentose, to appear in the urine. This may well be a product of disordered cellular metabolism, and it is a possibility that harmful effects may show their presence only after a long interval.

Dietary Sodium Chloride and Water Intake in Cardiac Oedema.

L. W. GORHAM, D. E. LESTER, A. V. WOLF AND H. H. SHULTZ (*Annals of Internal Medicine*, October, 1947) present a study of the relative importance of dietary sodium chloride and water intake in cardiac oedema. Investigation was made of twenty-two patients with oedema of congestive cardiac failure receiving a daily diet with less than 1.0 gramme of sodium chloride, and an additional eight patients receiving the hospital "cardiac general diet" containing 3.0 grammes. Daily fluid intakes were varied from 1000 to 7500 millilitres in different patients on different days. All medicines known to contain appreciable amounts of sodium were avoided. No mercurial diuretics were used in any of the cases reported, either during or for at least two weeks before the beginning of treatment, so that the effects of diet and fluids on sodium excretion could better be evaluated. All patients were fully digitalized at least thirty-six hours before the regimen was started, except for four who did not receive digitalis until the oedema had subsided. Some of the patients did receive ammonium chloride or ammonium sulphate, and all had congestive heart failure with clinical evidence of oedema. It was

found that with a diet containing less than one gramme of sodium chloride daily, the net loss of sodium and of oedema was greater than when 3.0 grammes of sodium chloride were given. The net loss of sodium and oedema was also greater when patients were encouraged to take 3000 millilitres of fluid daily, rather than be restricted to the customary 1500 millilitres. There is little added benefit from attempts to force the consumption of fluids in amounts above 3000 millilitres. The authors conclude theoretically that the fundamental object of the regimen in the treatment of cardiac oedema is the maintenance of a low ratio of sodium intake to water intake, rather than a low sodium or a high water intake *per se*. This concept provides a basis for evaluation of the relative importance of dietary salt and water in this regimen. It accounts quantitatively for the fact that restriction of salt to low intakes is more readily effective in relieving cardiac oedema than forcing the consumption of fluid to very high levels.

Hæmatemesis.

T. M. ROGERS (*The Journal of the American Medical Association*, July 17, 1948) has published an account of the successful treatment of gastric hæmorrhage by the topical use of thrombin. Thrombin is a sterile hæmostatic powder obtained from bovine plasma. It is alleged to clot fibrinogen and thus to seal the capillary ends. Ten thousand units of thrombin in 2.5 millilitres of isotonic sodium chloride were given by mouth to a patient with gastric hæmorrhage after vitamin K, liver extract, adrenaline and blood transfusions had been employed without success. Each transfusion seemed to initiate bright red vomitus. This first patient was over sixty years of age. The second patient was a boy of sixteen years. In his case 10,000 units of thrombin were given in saline on three successive days. Hourly feedings of skimmed milk and gelatin solution, with hard candy between feedings, was the diet adopted.

Exsanguination Transfusion in Leuchæmia.

A. PINEY (*The Lancet*, September 4, 1948), in a preliminary communication, reports the successful use of exsanguination transfusion to provoke a remission in a patient with acute leuchæmia. He states that the experiment arose out of various published observations suggesting that the cellular abnormalities in leuchæmia might possibly be due to abnormalities in the blood plasma, for instance the observation that intravenous injection of normal blood plasma into leuchæmic patients leads to a diminution in the number of myeloblasts in the blood. As large quantities of blood cannot be obtained at any one time in England, the author's patient was taken to Paris, where Tzanck transfused her with 14 litres of blood while 13.5 litres were withdrawn. A remission of the disease set in within twenty-four hours, and there was evidence that a vital reaction had been provoked in the patient and that she was not just "living on borrowed blood". The author thinks that there is reason to hope that by further small transfusions (and the use of urethane if necessary) it may be possible to prolong the remission until the leuchæmia passes into the chronic form.

British Medical Association News.

SCIENTIFIC.

A MEETING of the New South Wales Branch of the British Medical Association was held on September 23, 1948, at Sydney Hospital. The meeting took the form of a series of clinical demonstrations by members of the honorary medical and surgical staff of the hospital. Parts of this report appeared in the issues of December 11, 18 and 25, 1948.

Carcinoma of the Kidney.

DR. ALBAN GEE presented a married woman, aged fifty-five years, who had been referred to the urology out-patient department by Dr. E. L. Davis, complaining of a dragging ache in the left loin for the previous two months. She had lost a stone in weight during the past three months. She had had a poor appetite and some minor gastric upsets. She had not noticed any haematuria, but did think she could feel a lump below her ribs on the left side. In 1935 a hysterectomy had been performed, but nothing else was relevant in the past history. On examination a large, firm, smooth mass was palpable in the left hypochondrium, extending from the costal margin to the umbilicus. It filled the renal angle behind and had a definite edge to its inferior margin, but no notch was palpable. It was quite tender. Full examination of the urine revealed no abnormality. The blood pressure was 120 millimetres of mercury, systolic, and 80 millimetres, diastolic. A plain X-ray film of the abdomen revealed a large soft-tissue mass in the left hypochondrium, but no renal outline could be seen. An excretion urogram showing a filling defect of the lowest calyx of the left kidney, while the infundibular region of the calyx appeared to be very narrow as though it had been compressed. A cystoscopic examination was made; the urethra, bladder and ureteric orifices appeared normal. A catheter was passed to the left kidney without any obstruction's being met, and a specimen of urine was collected. A plain X-ray film again showed a large soft tissue shadow, while the catheter had been pushed medially to the vertebral bodies, skirting the medial aspect of this shadow. The pyelogram then taken showed more filling of the lowest calyx than was seen in the urograms, but the tip of the calyx was still cut off, and was very irregular. All the skiagrams showed the other calyces of the kidney to be normal and the right kidney also. In an indigo carmine test a good deep blue colour was obtained on the right side, but a considerably paler blue on the left side. Examination of the specimens of urine collected from the bladder and right kidney revealed no abnormality, but in that from the left side abundant red cells and a few epithelial cells were seen. Incubation produced a growth of *Staphylococcus albus*. Examination of the blood revealed that the red cells numbered 3,870,000 per cubic millimetre, with a haemoglobin content of 11.8 grammes per centum. The white cells numbered 6800 per cubic millimetre. X-ray examination with a barium enema showed some narrowing of the proximal part of the descending colon, which was freely mobile. An X-ray examination of the chest revealed no metastases or other abnormality. On April 7, 1948, a left nephrectomy was performed, and the patient made an uneventful recovery. The pathological report on the specimen removed was as follows:

The specimen consisted of the left kidney with a large almost spherical tumour measuring 12 centimetres in diameter, replacing the lower pole, together weighing 912 grammes. The cut surface of the tumour showed yellow friable tissue with regions of haemorrhage and intersecting bands of translucent tissue. The lesion had the appearance of encapsulation. Sections confirmed the diagnosis of a Grawitz tumour. The epithelial cells have a glandular or alveolar arrangement with scanty connective tissue containing abundant capillaries. In the section examined, the epithelial cells are all of the clear type, mostly with fairly uniform spherical nuclei. The apparent capsule is formed of compressed renal tissue.

In discussing the case, Dr. Gee pointed out that renal tumours constituted about 2% of all tumours in adults, and of those roughly 70% originated in the cortex. Their origin had been the subject of great discussion. In 1883 Grawitz challenged the then popular renal theory of origin by asserting that they arose from adrenal rests, and the term hypernephroma was suggested fifteen years later by Birch-Hirschfeld. Those terms had persisted, but the theory of adrenal rests had given way to the renal theory of origin,

and interest was centred in the role the renal adenoma played. Many believed that all gradations from the benign form to the highly malignant carcinoma might be seen in the one tumour. Two groups of adenomata had been described—those with large clear cells, the commonest, and those with small granular cells. Thus the cortical tumours had come to be termed adenocarcinomata. Haematuria was frequently absent in association with cortical tumours, and early symptoms might be very vague until a mass was big enough to make itself apparent either by being palpable or by causing pain. Although no metastases had been demonstrated radiologically, the prognosis in the case under discussion could not be too optimistic, as the tumour was large, and the best five-year survival figures published did not exceed 40%.

Female Bladder-Neck Obstruction.

Dr. Gee then presented two female patients, each of whom had had acute retention of urine, due to lower urinary tract obstruction, and each of whom had been cured by an endoscopic resection of the bladder neck. The first patient was a married woman, aged thirty-five years, who had attended the urology out-patient department on October 31, 1946, with the history of an attack of acute retention of urine one week previously which had been relieved by a fine catheter. She still had much frequency and great distress on micturition, and had to force the urine out. The urine was blood-stained and dirty and contained pus. Her past history contained much urinary trouble. In 1939 she had had acute retention which was relieved by catheterization. In 1941 she had had a further attack, but was left with some frequency of micturition. In May, 1942, she had complained of frequent attacks of acute strangury and pains in the lower part of the abdomen; her urinary stream had little force, and micturition required much straining. A small stricture was found with well-marked skentitis; she experienced considerable relief from a course of urethral dilations, but in June, 1942, again had to be catheterized on one occasion. She had then remained fairly well until seen in 1946, but always had to strain to pass urine and had a poor stream. She had had two children (aged thirteen years and two years respectively at the time of consultation), with retention of urine for two days following the birth of the younger. Cystoscopic examination in November, 1946, showed considerable granulation tissue in the external urethra and a very tight stricture of the urethra. The bladder was very inflamed and bleeding made vision poor. The patient was admitted to hospital, an indwelling catheter was inserted and irrigations with silver nitrate were instituted. A week later the bladder appeared much improved and the stricture much less noticeable. The urethra was well dilated. A "complete" positive result was obtained to the Wassermann test, and the result of the Kahn test was "four plus" positive. No tubercle bacilli were isolated from the urine which, however, contained abundant pus cells, many red cells, and on incubation a growth of *Bacillus coli communis*. She had a course of four arsenoxide (0.04 gramme) injections, and was discharged much improved on December 19, 1946, to undergo treatment for the syphilis. On March 6, 1947, she reported to hospital with increased frequency and had been passing gravel in the urine. Bladder washouts were instituted together with the administration of sulphonamides, but she steadily became worse, passing only small amounts of urine each time, and was in great mental distress. On April 2, 1947, cystoscopic examination showed pronounced urethritis with polypoid formations at the bladder neck. Many granulomata and bullae were present in the posterior part of the urethra and trigone area. The bladder capacity was very small, and a calculus was present. The patient was eighteen weeks pregnant. On April 7, 1947, the stone was crushed and removed, and six pieces of tissue were resected from the bladder neck and posterior part of the urethra with the Stern-McCarthy electrotome. Ten days later she was discharged passing urine freely, with instructions to report to the Women's Hospital. In August, 1948, she was delivered of a normal living child without any complications. At the time of the meeting, September, 1948, she was a new woman mentally and physically, said that she had never felt better in her life, and was completely free of any urinary symptoms.

The second patient was a married woman, aged thirty-one years, who had been admitted from the Women's Hospital suffering from acute retention of urine. Until four years previously she had been quite well, but after the birth of her first child she had had to be catheterized twice daily during her stay in hospital. She could pass urine on discharge, but had to strain a good deal for several weeks. In June, 1947, her second child was born, and again she developed retention of urine and had to be catheterized for five days. Since then she had had to strain to start, but

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once initiated micturition was normal. Six weeks before admission to hospital she had a miscarriage of a three months' fetus. She was treated at home by her own doctor for three weeks, and then transferred to the Women's Hospital, Crown Street, because of a non-resolving palpable mass in the right side of the abdomen. Three days after her admission there, acute retention of urine developed, and that persisted till her transfer to Sydney Hospital. Urine examination showed abundant pus cells and *Bacterium aerogenes*. No reaction to the Wassermann or Kahn test was obtained. Cystoscopic examination revealed evidence of inflammation at the bladder neck and posterior part of the urethra with some heaping-up of the mucosa of the floor. On the left side of the internal sphincter region there was a particularly large projection of mucosa jutting into the lumen. Endoscopic resection was performed a week later, and on removal of the catheter three days later she passed urine freely. She had since remained symptomless.

The Value of a Plain X-Ray Film.

Dr. Gee next presented two patients to show the value of early X-ray examination of the urinary tract. The first patient, a middle-aged married woman, was admitted to the skin ward with vulval dermatitis which had been present for nine months. Her history revealed that she had complained to her own doctor of aching pains in the right loin and right hypochondrium for some years, with increased symptoms for the past twelve months. There were no urinary symptoms. Examination of the urine revealed numerous pus cells and *Bacillus coli communis*. A Graham's test showed a functioning gall-bladder. Numerous opacities were present, almost certainly renal. Excretion urography showed no excretion of contrast medium on the right side. A nephrectomy produced a small fibrotic kidney containing numerous calculi, with almost complete destruction of the renal parenchyma. A plain X-ray film would have revealed the cause of her trouble even some years before. It was interesting to note that her skin condition disappeared very rapidly after operation.

The second patient was a single woman, aged thirty-nine years, who had complained of pains in the left iliac fossa on and off for over twelve months. She had had several attacks of severe pain with vomiting, the last three months previously. The pain did not radiate and there were no urinary symptoms. Her own doctor had been treating her for most of the period, but no X-ray picture had been taken. She came to the city and, at the Women's Hospital, Dr. K. A. McGarrity ordered an excretion urogram. That revealed a large calculus in the left ureter opposite the transverse process of the third lumbar vertebra, with considerable dilatation of the pelvis and calyces above. The diagnosis was confirmed by cystoscopic examination, and an early ureterolithotomy was performed. Excretion urography two months later showed a normal collecting system. Dr. Gee pointed out that there again a plain X-ray film of the urinary tract would have disclosed the cause of her symptoms, and that she was fortunate in having made such a good recovery. Examination of a plain X-ray film should not be omitted with recurrent pain, and no delay should occur in the ordering of an excretion urogram if abnormality of the urinary tracts was suspected.

Ureteric Calculi Treated Conservatively.

Dr. Gee finally showed two patients to illustrate that cystoscopic manipulations frequently enabled stones to be passed without recourse to operation. The first patient, a married woman, aged thirty-five years, was under observation for five months. She had had an attack of renal colic three weeks before reporting to hospital, and an excretion urogram revealed a stone just above the uretero-vesical junction. There was early dilatation of the ureter above the stone. A fortnight later a number 10 Braasch bulb was passed with some difficulty, and a ureteric meatotomy was performed. For the next month, except for occasional pains, she was quite well, and again the ureter was dilated. Two weeks later severe colic ensued and X-ray examination showed the stone right at the uretero-vesical junction. A second meatotomy was performed three weeks later, and a number 12 bulb passed with difficulty. Five weeks later an attack of colic was followed by the passage of the stone.

The second patient, a man, aged thirty-three years, was under observation for three months. He reported to hospital with a stone at the uretero-pelvic junction, and two weeks later numbers 10 and 12 bulbs were passed to dilate the ureter. A month later urograms showed considerable dilatation above the stone, and early admission to hospital was recommended. Two weeks later the stone was seen to have moved down past the brim of the pelvis,

and operation was postponed. A ureteric meatotomy was performed and the ureter below the stone again dilated. A month later an attack of colic led to the passing of the stone.

In discussing these cases Dr. Gee pointed out that a close watch must always be kept for impaction of the stone and damage to the kidney above it. Repeated X-ray examinations and cystoscopic manipulations were necessary, but by those methods open operation could frequently be avoided.

Post-Graduate Work.

THE POST-GRADUATE COMMITTEE IN MEDICINE IN THE UNIVERSITY OF SYDNEY.

Public Lecture by Professor L. S. P. Davidson.

The public lecture on "Food Rationing and Nutrition in Great Britain", by Professor L. S. P. Davidson, will now be given on Wednesday, February 23, 1949, at 8 p.m., in the Sydney Conservatorium of Music, Macquarie Street, Sydney, and not on Friday, February 25, as previously announced. Admission tickets are obtainable on application to the Secretary of the Committee, 131 Macquarie Street, Sydney. Telephones: BU 5238, BW 7483.

Correspondence.

THE AUSTRALIAN POST-GRADUATE FEDERATION OF MEDICINE.

SIR: The announcement of the formation of an Australian Post-Graduate Federation (THE MEDICAL JOURNAL OF AUSTRALIA, January 1, 1949) marks an important milestone in medical education and is the realization of a pipe dream to one amongst those present at the birth of the Melbourne Committee over twenty-five years ago. The parents on that occasion showed a prescience, which has been amply justified, when they chose the word "Permanent" as one of the fledgling's baptismal names. Of necessity the account in your leader dealt only with general principles, but may one be allowed to hope that, when full details are known, some provision will have been made for a small permanent secretarial nucleus, to make for continuity in general policy? Australian distances may prove a difficulty, but Australian ingenuity should be able to overcome this. Post-graduate work here did not reach its full stature till a permanent central coordinating body was set up. The change, from time to time, in the members and venue of the executive committee must prove profitable and a source of strength, as it makes certain that no aspect of post-graduate work will be neglected. It will lead also to a gentle spirit of emulation, which is to be commended, as competition is to be deprecated. The personnel of the first executive committee commands confidence and will ensure a flying start for the new body, and it would be a pleasure if I were allowed to offer them my sincere good wishes in their work. You refer, sir, in your leader to liaison, and, to function fully, liaison must be a two-way affair. It is suggested, therefore, that a pipe dream for the new Federation would be to find an Australian Arthur Sims who would make it occasionally possible for an Australian teacher to do his stuff in other parts of the Empire. I know such a visitor would be welcome in this country and his presence would not be regarded as an attempt "to teach his British grandmother to suck Australian eggs".

Yours, etc.,

JOHN H. ANDERSON.

Ruthin,
North Wales,
January 10, 1949.

RUBELLA RETINITIS IN TASMANIA.

SIR: I have read with much interest the discussion on "Rubella Retinitis in Tasmania" which appeared in the report on the Section of Ophthalmology of the Australasian Medical Congress (THE MEDICAL JOURNAL OF AUSTRALIA, October 9, 1948, page 418). There are several minor errors which require correction.

In the first place I was rather surprised that Dr. G. H. Barham Black had suggested that the failure of the South Australian members of the Ophthalmological Society of Australia to undertake routine ocular examinations of children deaf as the result of maternal rubella was due to my having apparently taken all the data with me to England. Actually, before my departure I left in the care of the Adelaide Children's Hospital reprints of the papers together with a roll of the names and addresses of the 157 children studied in the course of our investigations, including the 120 whose mothers had suffered during pregnancy from German measles. Perhaps I am to blame in not stressing my action to my colleagues, as apparently it was soon forgotten. At all events if Dr. Barham Black had been as enthusiastic to carry out the investigation as your report would indicate, I suggest that he could have communicated with me and I would have immediately rectified matters. (One can obtain a reply by air mail in three weeks.) Moreover, even if such records had been unavailable, it would still have been possible to study the ocular condition of the numerous children with post-rubella deaf-mutism attending the school conducted by the Oral Pre-School Group in Adelaide. The names of other children suffering this defect were in the records of Dr. A. L. Tostevin. As one who laboured for five years in this particular field of research, it makes me feel somewhat sad to be deemed responsible for hampering further studies.

According to the report, Dr. Barham Black stated that Dr. Gregg published his original observations in 1942 instead of in 1941.

I was astonished also to read that microcephaly as a component of the post-rubella syndrome was recognized at the time when Dr. Gregg read his first paper. I had always considered myself responsible for this discovery, having observed the condition at an early stage of the South Australian investigations.

In conclusion, it may perhaps be of interest to state that during a recent visit to Geneva, Professor A. Franceschetti was kind enough to show me some microscopic slides of rubella retinitis. The lesions were largely confined to the pigment epithelium. Dr. Franceschetti (see A. Franceschetti and J. J. B. Bourquin: "*Rubéole pendant la grossesse et malformations congénitales de l'enfant*", *Annales d'oculistique*, Volume CLXXIX, 1946, page 623) has termed the condition central pseudo-retinitis pigmentosa.

Yours, etc.,
CHARLES SWAN.

6 Haig Street,
Netherby,
Mitcham,
South Australia.
January 18, 1949.

MECHANIZED MORGUES.

SIR: As anyone knows who has done many post-mortem examinations away from the amenities of civilization, the most mentally and physically tiresome chore of a necropsy is opening the skull and thorax. For some years now I have used for this job a small circular saw (of the Albee type) actuated by an electric drill with a pistol grip. This reduces the work by about 90% and the time to a few seconds.

As all morgues have electricity and all commercial garages have the other equipment necessary I am passing the suggestion on generally.

Yours, etc.,
G. HARRIS.

Church Street,
Mudgee,
January 15, 1949.

A NATIONAL HEALTH SERVICE.

SIR: I have worked for a time in a nationalized medical service, and know only too well the dire result of governmental interference in the practice of medicine, and how political expediency, however slight, always takes precedence over medical necessity, however great.

That the practitioners of England are beginning to realize this, too, may be seen by consulting their letters in the *British Medical Journal* and *The Lancet*.

The Lancet recently ("Annotations", page 657) mentions an advertisement of a vacancy for a general practitioner in which the practitioner is required to live in a specified house in, of all places, Sheep Street, Birmingham. When our liberty to choose our place of abode is taken from us, we have indeed been herded into Sheep Street.

Let us then, for the sake of our consciences and our patients, resist all the efforts of the subman to drag us to his level. If we do not want the national health service, no one can foist it upon us.

But "the price of liberty is eternal vigilance".

Yours, etc.,
W.T.G.

December 18, 1948.

Royal Australasian College of Surgeons.

LECTURE BY MR. JULIAN TAYLOR.

MR. JULIAN TAYLOR, O.B.E., F.R.C.S. (England), L.R.C.P. (London), M.S. (London), examiner for the Royal College of Surgeons of England in Australia, whose lecture was postponed last month, will now deliver it at the Stawell Hall of the Royal Australasian College of Physicians, 145 Macquarie Street Sydney, at 8.15 p.m., on Tuesday, February 15, 1949. The subject will be "Intracranial Suppuration". This lecture is open to all members of the medical profession.

Australian Medical Board Proceedings.

NEW SOUTH WALES.

THE following letter has been received from the secretary of the New South Wales Medical Board.

Dear Sir,

I am directed by the New South Wales Medical Board to advise for the information of medical practitioners generally, that reciprocity of medical registration in terms of the *Medical Practitioners Act*, 1938-1945, has now been established between this Board and the South African Medical Council. Such reciprocity is in respect of graduates in medicine of the University of Sydney, who are registered with this Board, and graduates of the University of Cape Town, the University of Pretoria and the University of the Witwatersrand (Johannesburg) of South Africa.

It should be noted, however, that by a recent amendment of the law governing medical registration in South Africa, all applicants for registration in that country must be able to prove that they have, since obtaining their qualifications, served for at least twelve months as a resident medical officer in an approved hospital. The South African Medical Council has advised that it has agreed in principle to the recognition of hospitals in other countries where internships may be served, if they are of a sufficient standard.

It would accordingly be desirable for any person who might be interested in obtaining registration in South Africa to establish touch with this Board in the first instance, so as to obtain proof of identity and registration in this State *et cetera* before proceeding to that country. In addition, such person would need to obtain proof that he has carried out twelve months' service as a resident medical officer.

Yours faithfully,
G. R. FLEMING,
Secretary.

January 12, 1949.

TASMANIA.

THE undermentioned have been registered, pursuant to the provisions of *The Medical Act*, 1918, of Tasmania, as duly qualified medical practitioners.

McIntyre, David Edgeworth, M.B., B.S., 1948 (Univ. Melbourne), Launceston.
Keech, Ronald George, M.B., B.S., 1948 (Univ. Melbourne), Launceston General Hospital.
Penn, Henry Peter, M.B., B.S., 1948 (Univ. Melbourne), Launceston General Hospital.
Meagher, Francis John, M.B., B.S., 1948 (Univ. Melbourne), Launceston General Hospital, Launceston.
Telfer, Trevor Percival, M.B., B.S., 1948 (Univ. Melbourne), Launceston General Hospital, Launceston.
Shaw, George, M.B., B.S., 1944 (Univ. Melbourne), Repatriation Hospital, Heidelberg, Victoria.

Oakes, Aston Henry Mayne, M.B., Ch.B., 1942 (Univ. Bristol), Bothwell.
Sleeman, William John, M.B., B.S., 1947 (Univ. Adelaide), Royal Hobart Hospital, Hobart.

Hospitals.

ALFRED HOSPITAL MEMORIAL.

An honour board, containing the names of former resident medical officers of the Alfred Hospital who had fallen in the 1914-1918 and 1939-1945 wars, was unveiled on September 28, 1948, by Dr. A. Fay Maclure, president of the Alfred Hospital Old Residents' Association. Dr. Maclure used the following words:

Fellow Alfredians,

We have gathered together to engage in a very brief and very simple ceremony. We have met to pay homage to

those of our colleagues and friends who have died in the service of our country during two world wars by the unveiling of a memorial tablet in their honour.

The tablet itself is panelled of wood of the old oak tree which for many years cast its shade on the residents' dining room, and whose removal was necessitated by the erection of the new building. Its timber preserved and fashioned into this honour board now forms a link with the old hospital and the days of the First World War. The names are printed in letters of gold and are therefore imperishable. The ages vary from those of middle life and of men at the apex of their careers to those of the young men who had just completed their training in this hospital and had gone out with the imprint of the Alfred still fresh upon them.

The whole is symbolic of the spirit and the traditions of the Alfred. Above is the crest of the hospital with its emblem of the lighted lamp and its motto of "Service and Care". Beneath are the names of those whose sacrifice typifies its great tradition of "Service before Self".

The site has been well chosen. Here in the busiest part of this great hospital its people pass to and fro, day and night, in the course of their various tasks. Here the tablet remains, an ever-present reminder of the call to duty in its fullest sense and of all the high endeavour which that call entails. In these days of unrest and struggle and uncertainty it is easy by yielding to specious argument and plausible reasoning and the beckonings of the sirens of self-advancement and self-interest to place yourself in a position where your conduct may be called in question. See to it then that your ethical standards are such that they may be worthy of the high sense of duty that is represented in this tablet. Let none pass by this site who need cast down his eyes before the silent gaze of this memorial.

When the student and the probationer enter upon their training in this school, they commence a career in which throughout their lives they may enjoy very great privileges. Provided they are faithful to the demands and the traditions of their profession they are accorded the respect, the admiration, the trust, the confidence and even the affection of the community to which they minister. To no other group in our society does this honour fall in such high degree. It is the reward and the recompense of the doctor and the nurse.

But these privileges are not to be acquired without adequate endeavour on the part of the recipient. That essential effort is perhaps best expressed in the words of an old French adage "*noblesse oblige*", the interpretation of which is "rank imposes obligations" or "much is expected of you who would hold those high positions". The acceptance of a high social standing in the community compels also the acknowledgement of the responsibilities attaching to that position. So when you don the uniform of the nurse or the garb of the medical student you impose upon yourself the obligation to live up to professional standards, and the higher you may rise in the service of the Alfred through the offices of sister and house surgeon to those of the honorary medical staff, the greater and the more exacting become your responsibilities. To the senior members the injunctions of "*noblesse oblige*" apply in their highest degree, for by their precept and example to those whose training and education is entrusted to them, they will determine the efficiency and the ethical standards of the men and the women of the Alfred. What you expect of others you must firstly demand of yourself.

The founder of this Association and our great leader, Hamilton Russell, was accustomed to tell how his master,

Lord Lister, enjoined his students and nurses to regard the wards and operating theatres as "parts of a Grand Cathedral where all must tread lightly and with great reverence". This Listerian doctrine of the sanctity of the human body and the acknowledgement of the privilege of tending it in its ailments as a great honour has been incorporated into the traditions of the Alfred. As a measure of the extent to which these traditions are being upheld it is well that student and nurse, house doctor, sister and honorary medical officer should on occasions imagine in ward bed or on operating table there lies his parent, himself or his child and then ask whether his attitude, effort and conduct meet with his approval—for "to thine own self be true and it must follow as the night the day thou canst not then be false to any man", least of all to those men whom now we honour, for by their sacrifice you and I, your home, your loved ones are in security, whilst they have fulfilled in

the extreme their noblest ideal of "Service before Self".

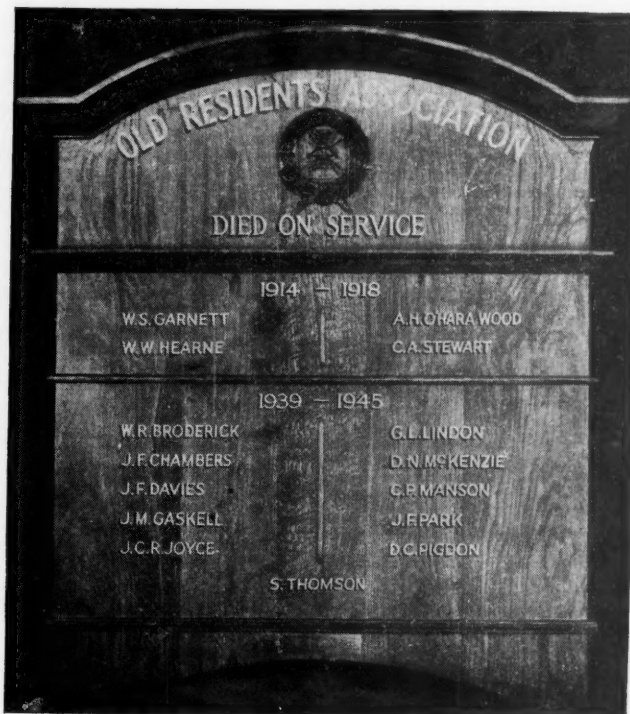
Now it is my proud moment to unveil this memorial—following upon which I ask for one minute's silence as our tribute of respect.

And now, as I know would be their wish, I bid you dismiss to carry on with your various duties, sure in the belief that the heritage they have handed on to you is safe in your keeping and that you will guard and guide it so that the Alfred will flourish and grow until it reaches its predestined place as a centre of nursing and clinical training, as a fount of medical knowledge and research and as the source of an ever-ready help to the sick and suffering of this community.

Nominations and Elections.

THE undermentioned have applied for election as members of the New South Wales Branch of the British Medical Association:

McReady, Phillip Archibald, M.B., B.S., 1946 (Univ. Sydney), Box 4380, G.P.O., Sydney.



Manchester, Edward Gordon Haig, M.B., B.S., 1948 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.

The undermentioned have been elected members of the South Australian Branch of the British Medical Association:

Smith, Mervyn Keith, M.B., B.S., 1944 (Univ. Adelaide), 29 Fisher Street, Fullarton, South Australia.

Fisk, Graham Bristow, M.B., B.S., 1946 (Univ. Adelaide), 25 Watson Avenue, Rose Park, South Australia. (130 A.G.H., Kure, Japan.)

Obituary.

CLARENCE GRAHAM GODFREY.

We are indebted to Dr. Paul G. Dane for the following appreciation of the late Dr. Clarence Graham Godfrey.

Clarence Graham Godfrey was born in Melbourne in 1867, his father being a well-known solicitor. He attended school at the old St. Kilda Scotch College, whence he matriculated to the University of Melbourne in 1884. He commenced the study of medicine, but later on proceeded to Edinburgh, where he qualified in 1890. Returning to Melbourne, he entered the service of the Mental Hygiene Department of Victoria on December 11, 1891. For twenty-eight years he worked in the mental hospitals of Victoria, most of this long period being spent at Royal Park, where he was superintendent for some years. On December 1, 1919, he was appointed Government Medical Officer, succeeding the late Dr. J. O'Brien. He remained in this position until April 3, 1932, when he retired. He also acted as medical officer to the police for many years and was a member of the Medical Board of Victoria until quite recently. Whilst he was superintendent at Royal Park he was appointed lecturer in psychiatry at the university.

Dr. Godfrey was responsible for the establishment of the Lara Institute for Inebriates, being able by his enthusiasm to persuade the Government to purchase this property. He was very interested in the care and treatment of drug addicts and attended this institute regularly for many years. Unfortunately Lara was subsequently closed, and since then there has been no government-controlled institute to treat drug addicts other than the mental hospitals.

Dr. Godfrey was always interested in psychological methods of treatment, and he was, as far as I am aware, the first to introduce treatment of both psychotics and psychoneurotics by hypnosis into Australia. He became very expert in this therapeutic method and used it with much success. When the war casualties of the 1914-1918 war began to drift back to Australia, Dr. Godfrey was requested to help in treating the "shell shock" cases. He worked at the old Number 5 Australian General Hospital and subsequently at the repatriation out-patient clinic up till shortly before his death. Not only did he use hypnosis as a means of "suggestion", but he made use of this method for abreaction and recall of amnesia. He did very valuable work along these lines—withstanding the scoffing of some of his colleagues. He was one of the first to recognize the tremendous significance of Freudian psychology, and during his later years he worked largely along analytical methods. It was the late Clarence Godfrey who opened the vast and over-fascinating realm of the mind and its disorders to myself, during those post-war years when we were faced with the tremendous task of dealing with disorders that up till then had received practically no recognition in our medical training. I owe a great deal to Dr. Godfrey's help and advice; both of these he gave freely. He was never enthusiastic about the modern shock methods of treatment; he considered that psychological disorders should be treated by psychological means as far as is possible.

Dr. Godfrey had few interests outside his work. However, he did admire a good horse and he loved to watch these noble creatures in the contests of speed. At times he owned a racehorse, but was never lucky enough to possess a champion. I well remember one day he won a race at Geelong, and he told me that it cost him about £10 more than the stake was worth to win it.

No one could meet Dr. Godfrey without immediately learning to like him; he had a great charm of manner and a compelling smile that won many a friendship. He was modest and unassuming and disliked publicity of any kind, but he was helpful and kind to many, especially to returned soldiers, numbers of whom will long remember the help that he so freely gave them.

Dr. Godfrey leaves a daughter and a son, Dr. Graham Godfrey; his wife and one son predeceased him.

JOSEPH ALEXANDER PARKES.

We regret to announce the death of Dr. Joseph Alexander Parkes, which occurred on January 30, 1949, at Sydney.

Diary for the Month.

FEB. 14.—Victorian Branch, B.M.A.: Finance, House and Library Subcommittee.

FEB. 15.—New South Wales Branch, B.M.A.: Medical Politics Committee.

FEB. 17.—Victorian Branch, B.M.A.: Executive Meeting.

FEB. 22.—New South Wales Branch, B.M.A.: Ethics Committee.

FEB. 23.—Victorian Branch, B.M.A.: Council Meeting.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment mentioned below without having first communicated with the Honorary Secretary of the Branch concerned, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

New South Wales Branch (Honorary Secretary, 135, Macquarie Street, Sydney): Australian Natives' Association; Ashfield and District United Friendly Societies' Dispensary; Balmalm United Friendly Societies' Dispensary; Leichhardt and Petersham United Friendly Societies' Dispensary; Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney; North Sydney Friendly Societies' Dispensary Limited; People's Prudential Assurance Company Limited; Phoenix Mutual Provident Society.

Victorian Branch (Honorary Secretary, Medical Society Hall, East Melbourne): Associated Medical Services Limited; all Institutes or Medical Dispensaries; Australian Prudential Association, Proprietary, Limited; Federal Mutual Medical Benefit Society; Mutual National Provident Club; National Provident Association; Hospital or other appointments outside Victoria.

Queensland Branch (Honorary Secretary, B.M.A. House, 235, Wickham Terrace, Brisbane, B.17): Brisbane Associated Friendly Societies' Medical Institute; Bundaberg Medical Institute. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL or position outside Australia are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.

South Australian Branch (Honorary Secretary, 178, North Terrace, Adelaide): All Lodge appointments in South Australia; all Contract Practice appointments in South Australia.

Western Australian Branch (Honorary Secretary, 205, Saint George's Terrace, Perth): Wiluna Hospital; all Contract Practice appointments in Western Australia. All government appointments with the exception of those of the Department of Public Health.

Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

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